

# AIR POWER

SPRING 2011 - Volume 58, Number 1  
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# *History*





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# AIR POWER

## History

Spring 2011 - Volume 58, Number 1  
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COVER: On July 21, 2009, at Edwards AFB, Calif., the Airborne Laser Test Bed's first chemical flight test demonstrated the safe flow of chemicals through all laser systems. ([www.mda.mil](http://www.mda.mil))



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We kick off the premier issue of 2011 with an article begun as a student paper. During summer 2010, USAF Academy Cadet Cameron Ross interned at Kirtland Air Force Base, New Mexico, at the Air Force Research Lab's Phillips Research Site history office. Mentored by Dr. Robert Duffner, Cadet Ross absorbed the trove of historical documents relating to the Airborne Laser (ABL) and interviewed two of the program managers. Then, as Lieutenant Ross, he refined the manuscript into its present state.

Undoubtedly, before the advent of the exotic airborne laser gun, the airman's weapon of choice was the laser-guided bomb (LGB). Darrel Whitcomb flew OV-10s and O-1s as a forward air controller in Vietnam. He participated in the employment and refinement of this revolutionary armament. A frequent contributor to *Air Power History*, Colonel Whitcomb informs and entertains with his sober account of the weapon's growing pains, but ultimate maturity.

As I read Darrel Whitcomb's manuscript, it occurred to me that his contemporaries and the younger officers now leading the Air Force know little about the research and experimentation conducted shortly before and during World Wars I and II to develop precision armaments. To remedy this, I reviewed my own research and writing on the subject. As a result the third article is drawn from a section of my history on the postwar development of guided missiles.

Next, is a piece by Dr. Alan Gropman, recipient of the Maj. Gen. I.B. Holley Award, presented to an individual who contributed greatly to the research and writing of Air Force History. Only about one hundred or so people were privileged to attend the annual awards banquet and hear the recipient's acceptance speech. So, it is fitting to present it in *Air Power History*. Entitled, "Speaking Truth to Power," Dr. Gropman urges historians to adopt the practice of the National Defense University and Air University Press "by removing the Pentagon from the censorship role."

Serendipitously, the fifth feature, a *Readers' Forum* submission, "speaks Truth to Power." Actually, it had spoken some forty years ago. The author was a USAF Academy graduate, and an active duty and antiwar USAF officer. Here he tells what motivated him to act as he did and why he does not regret it. Remarkably, he was able to continue in the Air Force, rise in rank and pursue successful careers in government and private practice.

There are twenty-one book reviews and some interesting new publications. (See pages 42-53.) Also, check out the upcoming veterans' associations reunions for 2011 and beyond. (See page 60.). Our customary departments, including Bob Dorr's "History Mystery," appear towards the back.

Don't miss the Foundation President's message on page 55. In addition, the call for papers and registration forms for this year's symposium, *Air Power and Global Operations: 9/11 and Beyond*, are on pages 56 to 58.



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# ORIGINS OF THE F



# AIRBORNE LASER



Cameron L. Ross

(Overleaf) YAL-1A, a modified Boeing 747-400F known as the Airborne Laser, lands on Runway 22 at Edwards AFB, Calif.

**IN THE 1991 GULF WAR...THE ONE GLARING DEFICIENCY IN U.S. COMBAT OPERATIONS WAS ITS FAILURE TO DEFEND AGAINST IRAQI BALLISTIC MISSILE ATTACKS**

**ONLY WITH MODERN TECHNOLOGICAL ADVANCES STARTING IN THE 1970s DID AN AIRBORNE LASER SYSTEM BECOME VIABLE**

Not long ago, high powered laser weapons seemed a possibility only in the world of Star Wars or Star Trek. While many Trekkies were intrigued by the notion of death rays, the actual use of such fanciful weapons seemed reserved only for future generations. However, research and technological developments by the United States armed forces over the past forty years has transformed the future into the present. This is clearly exemplified in the Airborne Laser (ABL) program, in which the U.S. Air Force has converted a Boeing 747 into a flying laser weapon. One look at the eye-like nose turret on the ABL aircraft and there is little doubt that the future is upon us at last.

The origins of the ABL program can be traced to a convergence of several elements in the early 1990s: an operational necessity, technological development, and dedicated people who pushed the program forward. Wartime activities during Operation Desert Storm, coupled with a rise in weapons proliferation, led Department of Defense (DOD) officials to acknowledge the need for improved defenses against theater missile attacks and created a foothold for the ABL to begin its ascent. Technological advances that resulted from four decades of government laboratories perfecting adaptive optics and high-power lasers helped generate the enabling technologies to make the ABL feasible. Moreover, the unwavering loyalty of the ABL supporters, who staunchly believed in the program's capability to complete the mission, drove the program past the early opposition of doubters and skeptics.

While Coalition forces in the 1991 Gulf War were markedly successful, the one glaring deficiency in U.S. combat operations was its failure to defend against Iraqi ballistic missile attacks. The Iraqis launched nearly 100 al-Hussein missiles, modified Soviet Scud-B missiles, with a large number of them directed at U.S. forces in Saudi Arabia.<sup>1</sup> U.S. Patriot Advanced Capability-2 (PAC-2) missiles served as the Coalition forces' only defense against the Scuds and were largely ineffective. According to officials, Patriot missile systems detected and targeted roughly 40 percent of the Scuds, and of those detected, successfully destroyed only about one in six.<sup>2</sup> The substandard interception rates were attributed mainly to errors in the radar and guidance systems, as well as a lack of missile maneuverability, while the inability to destroy the warheads was most likely the result of decoy debris. Some independent experts questioned

even this limited success and believed that Patriots did not destroy any Iraqi missile.<sup>3</sup> Efforts to destroy the Scud launchers in what became known as "The Great Scud Hunt," also proved futile. Despite advanced intelligence, the mobile launchers proved to be highly elusive and at the end of hostilities there were no confirmed kills of any Scud missile launchers.<sup>4</sup> The sub-par performance of missile defense systems pushed Congress to demand the rapid development and deployment of improved ballistic missile defense systems.

Increasing the demand for improved systems was the rise in weapon proliferation and the ever-advancing capabilities of weapons. Stockpiles of theater missiles in many developing countries had grown steadily since the end of the Cold War. By 1996, more than twenty nations had joined the ballistic missile club, with many others knocking on the door. Although the U.S. stopped exporting ballistic missiles in the 1970s, other nations including Russia, China, and North Korea put their weapons on the market.<sup>5</sup> Possession of ballistic missiles by such rogue nations as Iran, Libya, Iraq, Syria, and North Korea added further concern regarding proliferation. Increases in ballistic missile range and accuracy, coupled with many nations' desire to use ballistic missiles to carry warheads of mass destruction, only raised the stakes higher.<sup>6</sup> The exponentially growing threat of ballistic missiles, highlighted by Iraqi Scud missiles in the 1991 Gulf War, added increased urgency to Congress's call for the development of superior ballistic missile defense systems.

In responding to the threat, theater missile defense officials in the DOD and the Strategic Defense Initiative Organization (SDIO) realized that no one system alone could counter the threat. Instead, it required a "balance of integrated attack operations, comprehensive active defense against missiles in flight, extensive passive measures, and a robust C<sup>3</sup>I and surveillance capability."<sup>7</sup> Within that construct, ABL would fall into the tier of boost-phase intercept. In its most basic description, the ABL is essentially a flying laser weapon. Composed of four laser systems, as well as an adaptive optics system, the ABL is an extremely complex machine. The aircraft flies above cloud level, orbiting at around 40,000 feet. When a missile is launched, the ABL's Active Ranger System detects the launch and provides preliminary tracking data on the missile. The Track Illuminator Laser (TILL) then locates the missile and begins tracking its path and

*In May 2010, 2d Lt. Cameron L. Ross graduated from the United States Air Force Academy as a Distinguished Graduate and he was also the Top Graduate in American history. He wrote the "Origins of the Airborne Laser" as part of a summer research project at the Air Force Research Laboratory's Historical Office, at Kirtland AFB, New Mexico, where he worked under the direction of Dr. Robert Duffner. For his work on the paper, Lieutenant Ross received the 2010 Thomas D. Moore Award - Humanities Division, for best original cadet research. While at the Academy, Lieutenant Ross was also extremely involved with the men's basketball team as Student Assistant Coach, in addition to multiple clubs and bible studies within the cadet wing. Currently, he is undergoing intelligence training at Goodfellow AFB, Texas. He hopes to pursue a master's degree as well as a doctorate in American history and return to teach history at the Air Force Academy.*





YAL-1A Airborne Laser in flight with the mirror unstowed

**BY THE 1990s  
THOUGH,  
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SYSTEM**

position while the ABL's Beacon Illuminator Laser (BILL) measures the amount of atmospheric disturbance from the aircraft to the target. To destroy the boosting missile, the ABL fires its Chemical Oxygen Iodine Laser (COIL) using the adaptive optics system to compensate for atmospheric turbulence, heating up the pressurized missile until it is disabled.<sup>8</sup> Its speed-of-light delivery of the laser allows ABL to be effective from long distances, permitting the ABL to fly in friendly airspace and still engage missiles hundreds of kilometers away.<sup>9</sup> These combinations made the ABL concept a formidable prospect for theater ballistic missile defense.

Only with modern technological advances starting in the 1970s did an airborne laser system become viable. For example, the Airborne Laser Laboratory (ALL) was a technology development program from 1971-1983 designed to lay the groundwork and prove the physics and feasibility of airborne lasers, before the Air Force would even consider building a weapon prototype to satisfy an operational need. ALL was the Air Force's first attempt at using a laser weapon from an aircraft. The program culminated in 1983 when it shot down five air-to-air missiles over the China Lake Test Range in California, and one BQM-34 drone over the Pacific Ocean.<sup>10</sup> However, the CO<sub>2</sub> laser used on the ALL proved too weak to extend the lethal range to operational distances. Atmospheric compensation technologies also needed further development to overcome the effects of the atmosphere on the laser, and significant advances in the optical coatings of beam control mirrors were required to meet higher power requirements. In addition, the ALL components were too heavy to

provide an operationally effective weapon. In essence, the technology necessary to make the ALL an operational weapon was not available.<sup>11</sup> However, the ALL concept demonstrated the scientific proof-of-concept for using lasers as weapons on aircraft.

By the 1990s though, many scientific advances allowed the ABL concept to become a realistic weapon system. One momentous technological development came with the development and improvement of the COIL laser. First demonstrated in the late 1970s, the Air Force Weapons Laboratory at Kirtland Air Force Base experimented with modifications to improve the COIL technology and laser throughout the 1980s. By 1990, experiments demonstrated important increases in power levels, beam quality, and an improved design of an efficient zero-gravity oxygen generator, crucial to the creation of the COIL beam. Originally planned for a Ground-based Laser (GBL), improvements in COIL made it a viable option for the ABL.<sup>12</sup> Because the COIL operated at a shorter wavelength, it provided a much longer range capability, which made it an appealing choice for a future airborne laser weapon. In 1994, Phillips Laboratory developed the VERTICOIL flowing chemical system that greatly reduced weight and minimized the fuel consumption, which also meant a further diminution in weight due to less laser fuel required on the aircraft. The Lab's development of a plastic fabricated Singlet Delta Oxygen Generator (SOG) instead of the traditional nickel built SOG's cut weight even more.<sup>13</sup> These advances all helped create a laser much more powerful and weighing significantly less than those utilized on the ALL.



**BY 1992,...  
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OPTICS  
SYSTEM**

While the COIL laser advancement was considerable, another one of the most significant scientific advancements for making ABL feasible was the development of adaptive optics. Regardless of how powerful the COIL laser was, it was only half of the solution towards delivering enough energy to the target. When fired across the massive distances that the ABL requires, the atmospheric turbulence distorts and diffracts a laser beam, reducing its lethality. Although the ABL flies at an altitude above most turbulence, compensation is still required. The adaptive optics system tailors the beam to the right shape and quality to compensate for the atmospheric turbulence and focus a high-energy beam on the target long enough to disable the missile.<sup>14</sup> With the advancement of wave front sensors, high-speed computers, and deformable mirrors—the key components of an adaptive optics system—it became possible for an ABL to reduce the detrimental effects of atmospheric turbulence on a high-power beam.<sup>15</sup>

Adaptive optics arose primarily in the late 1980s and early 1990s, when the Air Force Space Command expressed interest in imaging objects in space, not only to identify objects, but also to monitor and correct satellite operating deficiencies. By 1992, Dr. Robert Q. Fugate and a team of scientists, engineers, and technicians from Phillips Laboratory had designed, built and operated the world's most technically advanced adaptive optics system at the lab's Starfire Optical Range (SOR). They were able to precisely measure the distortion in sunlight reflecting off objects like stars and satellites. More importantly, they were able to construct an extremely sophisticated system capable of correcting for the deformations in the light to create a

clear image.<sup>16</sup> While this had sweeping consequences on astronomy and space interests, it was also monumental for programs like the GBL and ABL. Groundbreaking adaptive optics advances would allow for radically increased firing ranges, permitting a laser to be effective from the distances necessary for the ABL to complete its mission.

With the fundamental pieces in place, all that was needed were dedicated and focused people to present the difficult sales pitch that would make the ABL a reality. When the demands for improved systems rang out, a reverberation came primarily from two individuals: Col. Leonard J. Otten, director of the Phillips Laboratory Lasers and Imaging Directorate, and Col. Lanny J. Larson, deputy director of the Strategic Defense Initiative Organization (SDIO) Directed Energy Directorate. These two influential men played the lead role in making the original recommendation for an airborne laser based missile defense weapons system.<sup>17</sup> Both had remarkable résumés in laser research and airborne applications. As a junior officer in the Air Force Weapons Laboratory (AFWL), Otten conducted critical wind tunnel testing to ensure that the ALL would be stable enough to fly in the 1970s, along with many other invaluable contributions to the ALL program. He eventually rose to become the last commander of the Air Force Weapons Laboratory.<sup>18</sup> Colonel Larson was also deeply involved in the ALL efforts, serving as a beam control systems engineer for five years. He later became the program manager for laser radar, large optics technology, and interactive discrimination programs for SDIO and eventually attained the position of deputy director for the SDIO Directed Energy Directorate.<sup>19</sup> Both men had wit-

(Near right) Gen. John M. "Mike" Loh.

(Far right) Col. Leonard J. Otten, III.



**LOH'S SUPPORT FOR THE PROGRAM WAS CRUCIAL AND WOULD BE REQUIRED TO HELP GET THE PROJECT MOVING AGAIN**

nessed the potential of an airborne laser, as well as laser weapons systems, and firmly believed in the ability of a future ABL to answer the nation's need for improved missile defense. In 1991, they began lobbying for approval of an ABL program.

Larson's efforts resulted in the SDIO director, Ambassador Henry F. Cooper, initiating ABL studies in November 1991, as one of many possible solutions to inadequate theater missile defense.<sup>20</sup> By early 1992, SDIO, Space and Missiles Center (SMC), and Phillips Lab had joined forces to perform an extensive series of measurement and analysis studies to assess the feasibility and costs of building an airborne laser for missile defense. They also thoroughly examined the technology's "proof-of-concept" work done by the ALL, which Otten and Larson were all too familiar with.<sup>21</sup> At the time, the technology for the airborne laser primarily resided at Phillips Lab, which was under SMC and the Air Force Material Command (AFMC). The then acting commander of SMC, Lt. Gen. Edward P. Barry, did not feel an airborne laser was a solid option though, and he told Otten and the lab to cease and desist with the technology.<sup>22</sup>

Otten, understanding the enormous potential of the system, sought the support of other high-ranking officials in order to press the ABL concept. Otten and Larson briefed Gen. John M. Loh, commander of Air Combat Command (ACC), on the ABL concept to gain his endorsement to conduct more analysis of the program early in 1992.<sup>23</sup> Due to the ABL mission, the ACC planned to use the ABL aircraft, if it became operational. Therefore, Loh's support for the program was crucial and would be required to help get the project moving again.<sup>24</sup>

Loh, among others, recognized the value of

ABL, especially as a boost-phase interceptor. Theater missiles are most vulnerable in the boost phase of their launch for several reasons: they are easy to target because of their bright exhaust plume, they present a fairly large target under considerable stress, and they are unable to deploy effective countermeasures. Plus, if destroyed while boosting, the warhead carried on the missile would be dispensed over the nation that launched the missile, harming their citizens and country. The threat of a nation's own warheads falling over their own soil fundamentally deterred missile launches in general.<sup>25</sup>

Through the persuasion of Otten and Larson, General Loh gradually became a strong supporter of ABL. In August 1992, Loh along with the commander of AFMC, Gen. Ronald W. Yates, and the commander of Air Force Space Command, Gen. Charles A. Horner, wrote a letter to Secretary of the Air Force Donald B. Rice urging that the ABL be expanded in two dimensions: "first, a near/midterm upgrade of existing systems and second, a longer term demonstration and prototyping of the technologies for new force structure capabilities."<sup>26</sup> Loh liked the benefits of the ABL and although hesitant to place all his eggs for missile defense in the ABL basket, he soon became a strong lobbying force for ABL.<sup>27</sup>

Although still opposed to the program, General Barry established a Systems Program Office cadre at Phillips Lab with the Space and Experiments Directorate on August 19, 1992, after the Chief of Staff of the Air Force, Gen. Merrill A. McPeak, agreed to proceed with the program.<sup>28</sup> He temporarily assigned Col. Eugene R. Dionne, then head of the Space and Experiments Directorate, the additional duty of ABL program director and

A technician examines the Airborne Laser nose turret, and the mirror which reflects the laser.



Inspection of the nose turret (open) of the Airborne Laser aircraft.



appointed Otten as the ABL Senior Technical Advisor, "to take maximum advantage of his extensive experience with the ALL and the technology base supporting ABL."<sup>29</sup> In 1993, Larson was appointed director of the Lasers and Imaging Directorate at Phillips Lab where he was heavily involved in the technology development for ABL.<sup>30</sup> By the time Colonel Otten retired in late 1993, the two men had helped the ABL idea gain considerable momentum.

General Yates selected Col. Richard D. Tebay, in October 1992, to become the full time ABL acquisition manager and he relieved Dionne of his temporary duties in December of that year. From that point on until his retirement in 1997, Tebay would build up the program from virtually nothing and drive it from its humble beginnings to the contract signing in November 1996, that signaled ABL's status as a major acquisition program. Upon his arrival at Kirtland AFB, Tebay immediately began working to obtain funding for the program. After "parking himself" in the office of the Secretary of the Air Force's Acquisition Office, Tebay eventually progressed to General McPeak's office, where he briefed the Chief on the merits of moving ahead with the ABL. McPeak endorsed Tebay's plan and gave him \$20 million in start-up money to launch the ABL program.<sup>31</sup> Late in 1992, Tebay began structuring the ABL acquisition strategy and by early 1993 he established a formal acquisition plan.<sup>32</sup> In March of that year, Phillips Lab established the ABL Systems Program Office (SPO) at Kirtland with a mere seven positions, which Tebay hand selected.<sup>33</sup> The ABL's foot was in the door.

The ABL acquisition program consisted of a competitive concept design effort by industry, supplemented with a technology insertion endeavor conducted by Phillips Lab's Laser and Imaging Directorate, the Advanced Weapons and Surviva-



Col. Richard D. Tebay.

**THE SPO RECEIVED ONLY TWO INDUSTRY PROPOSALS, ... ON MAY 9, 1994, TEBAY AWARDED BOTH TEAMS EQUAL \$22 MILLION CONTRACTS**

bility Directorate, and the Massachusetts Institute of Technology's Lincoln Laboratory. Basically, it would be a cooperative effort among these organizations and the two Concept Design industry teams. The effort comprised of two phases: a thirty-three-month Concept Definition phase and a seventy-seven-month Program Definition and Risk Reduction (PDRR) phase which would culminate in a test shoot-down of a ballistic missile.<sup>34</sup> The Concept Definition phase would primarily consist of selecting two industry teams to submit designs for building an ABL capable of destroying missiles in the range of hundreds of kilometers. Air Force officials would decide at the end of the Concept Design phase whether the program would continue on to the next step of PDRR phase. If given the green light, the Air Force Acquisition Office would select the most capable of the industry teams to begin turning their proposal into reality. The SPO released the Request for Proposal to 142 potential industry bidders on June 30, 1993.<sup>35</sup>

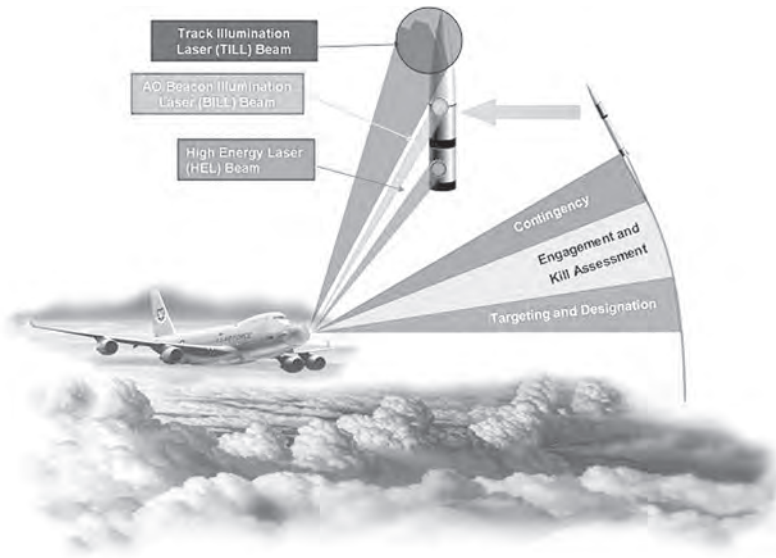
Prior to selecting two proposals however, the DOD zeroed out all ABL funding in mid-1994 during the Fiscal Year 1995 budget planning process citing "extreme budget pressures."<sup>36</sup> Without funding for the future, the program would have no reason to continue on with the selection process. The ABL SPO immediately undertook a comprehensive initiative, and through the tireless efforts of Tebay and General Loh, they were able to persuade General McPeak to restore \$20 million in funding

for the Concept Design and technology efforts for fiscal year 1995.<sup>37</sup>

Due to the complexity of the state-of-the-art technology involved with the ABL, the SPO received only two industry proposals, one from a Boeing-led team and the other from a Rockwell International team.<sup>38</sup> On May 9, 1994, Tebay awarded both teams equal \$22 million contracts for Concept Designs of advanced technology demonstrators and fully operational weapon systems, over a 33-month time frame.<sup>39</sup> This marked the beginning of each team's efforts to provide the best proposal for an ABL system and prove they could deliver on that proposal. Six months later, Loh again provided a lift to ABL when he announced that Kinetic Kill Vehicles would be moved to a lower U.S. strategic defense priority to be replaced by ABL to attack ballistic missiles.<sup>40</sup>

Because ABL was a highly publicized and push-the-envelope type program, there were many critics who expressed their skepticism over whether the system could actually function. Before Air Force leaders, and more importantly Congress, bought into the program, they wanted to ensure the money and efforts would be spent wisely. Consequently, the SPO and Phillips Lab engaged in a number of experimental demonstrations to disprove the nay-sayers, and convince themselves that the technology would work.<sup>41</sup> Phillips Lab conducted the Airborne Laser Propagation Experiment (ABLE-X) in 1993, over the White Sands Missile Range in New Mexico. One of the most important tests, ABLE-X was the first propagation experiment designed to demonstrate the propagation physics performance limits of a conventional adaptive optics system and it was a great success.<sup>42</sup> Essentially, it demonstrated that current adaptive optics technology could be used in an effective ABL system. In 1994, the ABL team at Phillips Lab conducted successful tests at White Sands demonstrating the ability of a laser to produce catastrophic structural failure on full-scale missile fuel tank replicas.<sup>43</sup> Boeing testing completed in 1995 proved that their ABL team could adjust for the vibrations of the aircraft when firing the laser. The most significant test came later that year though, with the Airborne Laser Atmospheric Characterization Experiment (ABLE-ACE). The \$18 million project completed its mission of collecting data during a series of high-altitude laser propagation measurements at various locations throughout the world. Knowledge gained from the project provided the most precise information needed for validating laser beam propagation simulation tools and modeling methods required for designing and building the ABL.<sup>44</sup> The completion and success of all these experiments gave Tebay much needed firepower to combat the criticism facing the ABL.

The culmination of the origins period of the ABL came in 1996, when the Air Force awarded the contract for the PDRR phase. Both teams submitted their proposals to the SPO on July 8, 1996. Originally, the acquisition schedule called for the contract selection in early 1997. However, Boeing



Employment diagram for the Airborne Laser.

announced on August 1, 1996, that they reached an agreement to purchase Rockwell's Defense and Aerospace businesses in December. In order to avoid any possible perturbations from the anticipated acquisition, the Air Force moved the selection up to November 1996.<sup>45</sup> On November 12, the Air Force announced the award of a \$1.1 billion contract to Boeing Defense and Space Group based on three major strengths of their proposal: the TRW-

developed COIL laser, a ballistic missile command and control system, and Boeing's logistical support.<sup>46</sup> By signing the contract to begin the PDRR phase, the ABL had reached the next level of a major acquisition program and secured its place at the table for missile defense.

For the ABL to reach the point of signing a PDRR phase contract, it took the combined effect of three elements: an operational necessity, technological advances, and people committed to making it a reality. Without the urgency and need that came from the inability to protect forces from Iraqi Scud missiles, the ABL would have had no foothold to get started. Without the technological developments in COIL and adaptive optics in the late 1980s and early 1990s, the ABL would not have even been feasible. And without the efforts of many knowledgeable people, including Colonels Otten, Larson, and Tebay, and General Loh, to sell the ABL and push it forward, the program would have foundered early on. The perfect synergy of elements all came together at the same time allowing the ABL to emerge as a revolutionary laser missile defense program and eventually become the Air Force's number two acquisition program behind the F-22. In 2002, Americans saw part of that vision achieved when the first ABL performed its maiden flight. The final validation of the ballistic missile shoot down finally occurred on February 12, 2010. ■

The Airborne Laser YAL-1A cruises over snow-capped peaks.



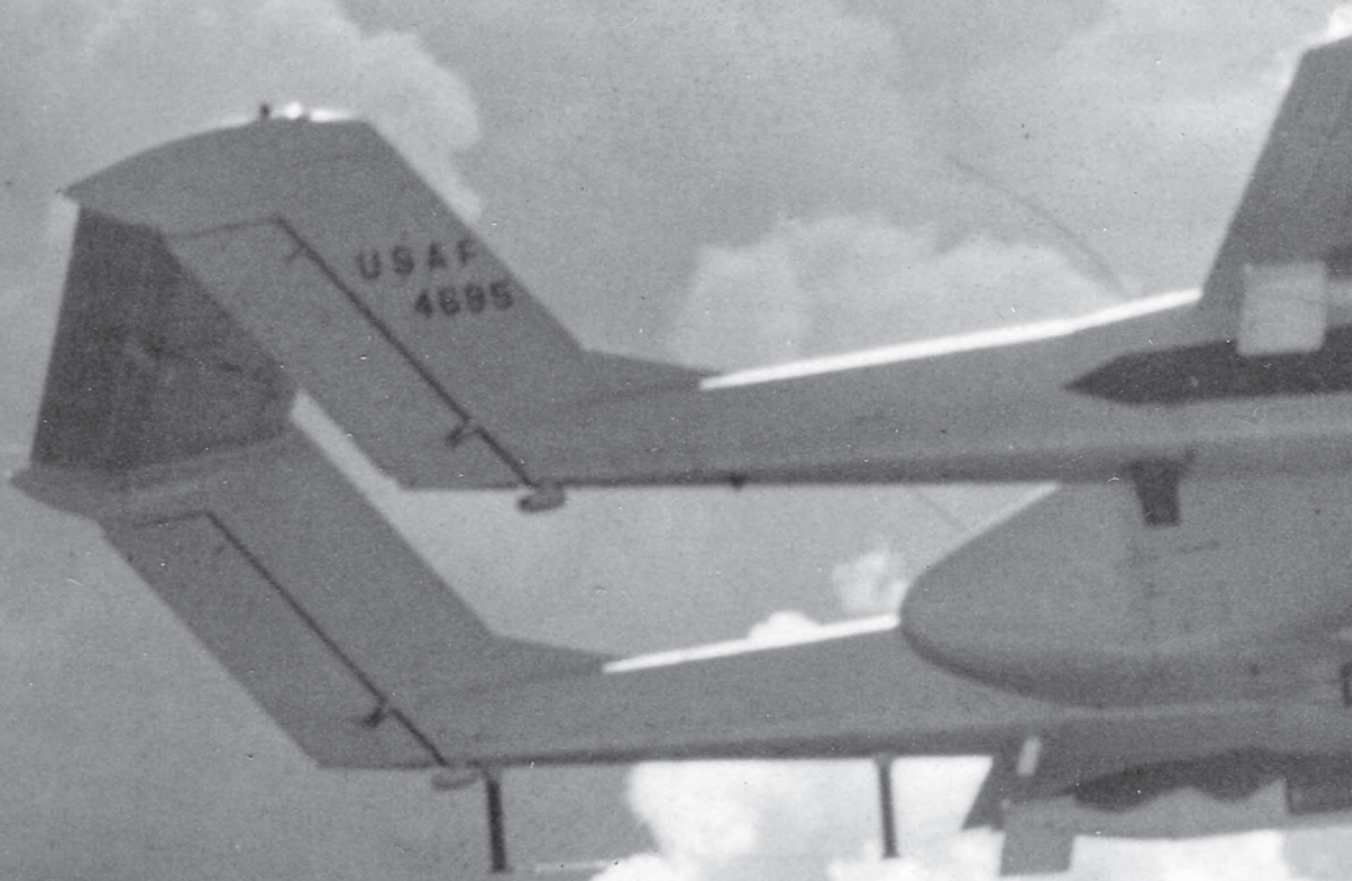
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## NOTES

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# PAVE NAIL: There at the Beginning of the Precision Weapons Revolution







Darrel Whitcomb

(Overleaf) PAVE NAIL on mission. (Unless otherwise noted, all photos courtesy of the author.)

IT WAS NOT UNTIL THE LATE STAGES OF THE WAR IN SOUTHEAST ASIA THAT THE USE OF PRECISION WEAPONS BECAME COMMON-PLACE

The images are all too common now. A target is designated with a set of cross hairs, and a guided *smart* weapon destroys it in a blinding flash. Today, U.S. air power engages primarily with precision weapons. In the initial campaign of Operation Iraqi Freedom, 68 percent of all aerial weapons used were precision weapons.<sup>1</sup>

It was not always so. In fact, it was not until the late stages of the war in Southeast Asia that the use of precision weapons became commonplace. A desire for precision delivery had long haunted airmen. Several attempts, dating back to World War I and through Korea, had been made to develop radio-guided bombing. While several developments looked promising, our ability to deliver overwhelming force and then nuclear weapons supplanted them, and the efforts were not fully developed.

The initiation of sustained bombing campaigns in the conflict in Southeast Asia and the increasing sophistication and lethality of modern air defense systems once again generated increased interest in precision weapons, and several initiatives were pursued. One of the most promising concepts was a proposal to use new LASER (Light Amplification by the Stimulated Emission of Radiation) technology to guide maneuverable bombs directly to a target. This concept consisted of two components: A guiding or illuminating device which could designate the target by holding a beam of LASER energy on it, and a bomb which was equipped with an *eye* that could see the illuminated target and then provide guidance to a steering mechanism attached to the actual bomb which could maneuver it to the target. This concept was created and developed by Texas Instruments (TI) engineers and eventually the Tactical Air Warfare Center (TAWC) at Eglin Air Force Base, Florida, for an actual initial cost under \$100,000. Under the contract, TI produced fifty-five of the bomb modification kits, called PAVEWAY. The

kits were placed on Mark-117 750 lb bombs and MK-84 2,000 lb bombs which were carried aloft by F-4s. Another F-4 was equipped with a ZOT-Box LASER system for target illumination. Combat testing validated the concept in late 1967, and clearly showed that the Mk-84 bomb was the superior weapon. Smart weapons were now available for tactical air forces.<sup>2</sup>

By the summer of 1968, the system components were flowing to Thailand for use by the Ubon-based 8th Tactical Fighter Wing (TFW). The first illuminators shipped over were the ZOT-Box LASER systems. However, those units were difficult to use and maintain and by 1970, were replaced by newer PAVE KNIFE Pods which were specifically designed to be efficiently carried by the 8th TFW F-4s.

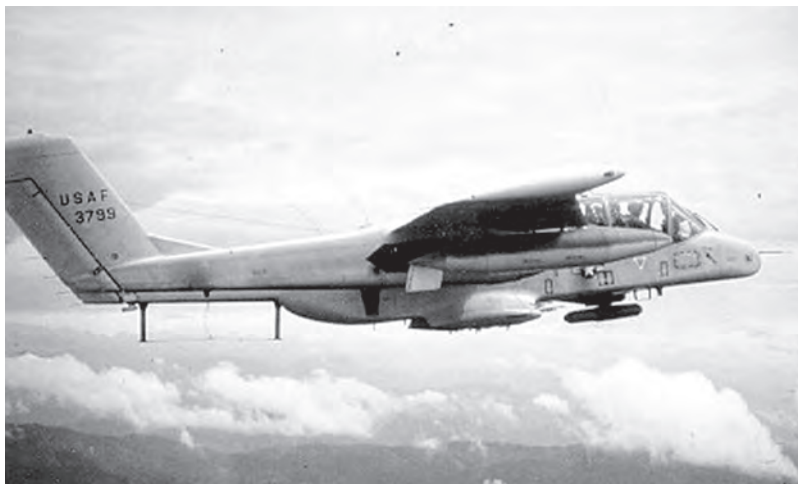
They were accompanied by an increasing number of PAVEWAY bomb kits which would be used to convert conventional bombs into the smart weapons. As production increased, the individual cost of each kit eventually dropped to \$2,500 each. Ironically, as they became available in significant numbers, the air campaign against North Vietnam had been halted. Instead, a significant amount of U.S. air power was directed primarily to the interdiction effort against the Ho Chi Minh Trail (HCMT) in eastern and southern Laos. The overall campaign was called COMMANDO HUNT.

Used by the North Vietnamese since 1959 as a conduit for troops and supplies from North Vietnam into South Vietnam and Cambodia, the HCMT had, by 1969, grown into a massive complex of interconnected roads down which an ever increasing volume of men and materiel was flowing. Since the early 1960s, U.S. air power had been used to interdict this flow. With the cessation of air strikes over the North, though, those available sorties were added to the effort against the HCMT. The newly arriving PAVEWAY bombs were thrown into the fray, and were soon being delivered by the 8th TFW F-4s.

Also working over the Trail with the strike aircraft were U.S. Air Force forward air controllers (FACs). One of the FAC units was the 23d Tactical Air Support Squadron (TASS), based at Nakhon Phanom (NKP) Air Base, in northeastern Thailand. First deployed there in 1966, the unit used the aerial call sign *Nail*. The 23d TASS FACs initially flew O-1s, then O-2s and by 1968, OV-10s to patrol the HCMT from the entry passes at Mu Gia, Ban Karai, and Ban Ravine, all the way south to its exit points into South Vietnam and Cambodia.

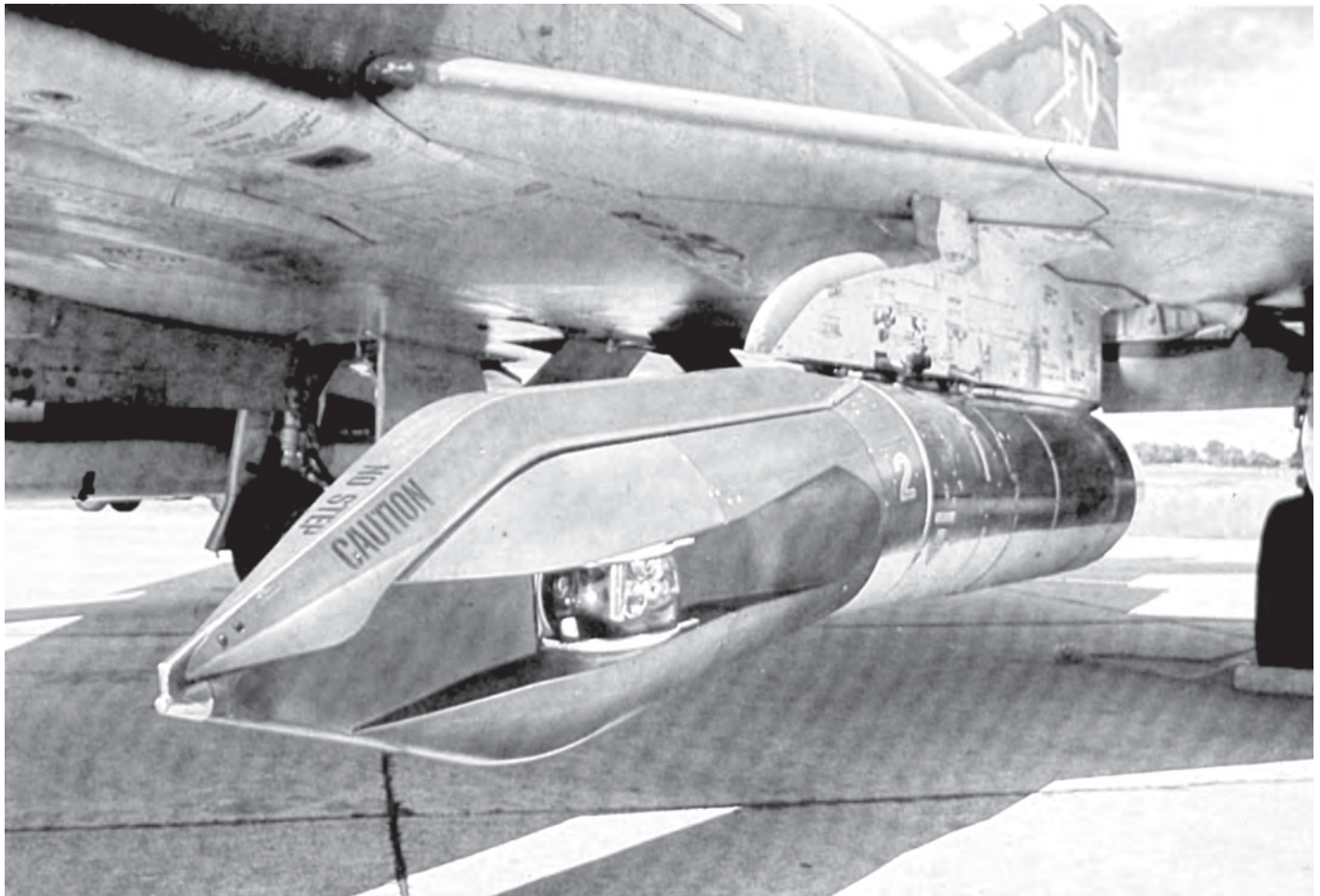
Immediately realizing how much more effective the PAVEWAY bombs were than the standard unguided or *dumb* bombs, the NAIL FACs increasingly requested the LASER guided bombs or LGBs, as they soon came to be called. The F-4s generally

PAVE NAIL in flight.



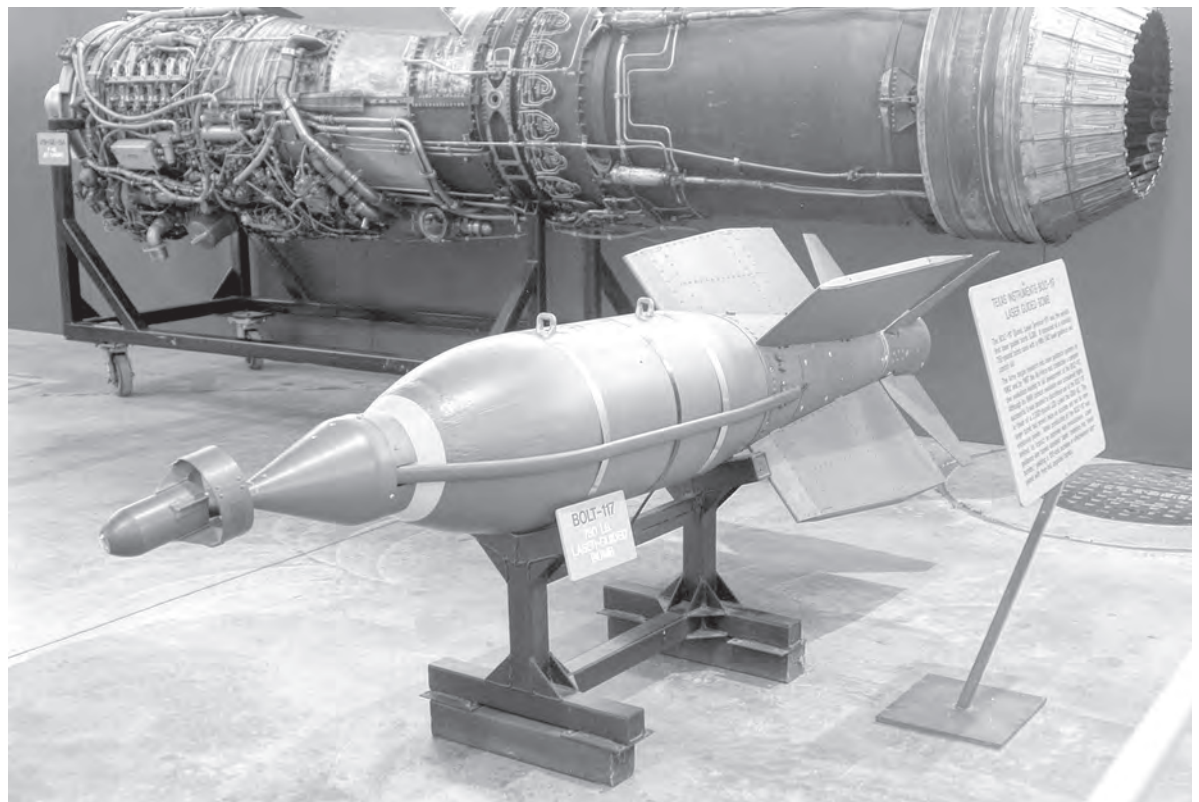
*Colonel Darrel Whitcomb, USAF (Ret.), served as a forward air controller flying the OV-10 and O-1 as a Nail and Raven FAC in Southeast Asia from 1972 to 1974. He is a prolific writer of Air Force and aviation history. His two most recent books, Call Sign—Dustoff: A History of Army Aeromedical Evacuation from Conception to Hurricane Katrina, and On a Steel Horse I Ride: A History of the MH-53 Pave Low Helicopters in War and Peace, will be published in 2011.*





An AN/AVQ-10 Pave Knife pod under the wing of an F-4.

An early laser guided bomb, the 750-lb. Bolt-117, which was superseded by the heavier GBU-10, a 2,000 lb. bomb.





The author in front of his OV-10.

**TO MITIGATE THE GROWING THREAT, COMMANDERS AT SEVENTH AIR FORCE DIRECTED THAT MORE PRECISION BOMBS BE USED**

were employed as flights of two aircraft, with the leader carrying the illuminator device and the wingman carrying the MK-84 bombs. The FACs employed them against critical points along the Trail where they could deeply crater the road bed or cause earth slides to block the road. They were also used to destroy cave supply complexes and vehicles, especially prime tracked movers, such as bulldozers, tanks or heavy equipment vehicles.<sup>3</sup>

As the North Vietnamese forces increased their use of the HCMT, they brought in more air defensive systems to protect it. To mitigate the growing threat, commanders at Seventh Air Force directed that more precision bombs be used. The Americans recognized that they would need more illuminators, especially at night, and published Combat Requirement Operational Capability (CROC) 25-70 which specified the need for “an OV-10A night visual reconnaissance system that would include the capability to search for, acquire, track, and designate targets for delivery of LASER guided bombs by LORAN-equipped strike aircraft.”

PACAF concurred with this request and gave it top priority. In response to this request the Air Force Aeronautical Systems Division developed a proposed modification for the OV-10. The Air Staff approved it and on September 18, 1970, the Chief of Staff of the Air Force signed out a directive to the Tactical Air Command (TAC) assigning it responsibility for the operational testing, development of tactics, determination of operational suitability, and combat evaluation of the system. TAC, in turn, directed the TAWC at Eglin AFB, Florida, to do the initial testing.<sup>4</sup>

Based on what they had learned using the F-4s, the TAWC engineers proposed modifying fifteen OV-10s by adding a LASER designation system called PAVE SPOT. This system would incorporate a low light level capability with some magnification for day or night target identification and LASER designation capability, and would be stabilized and gimballed for moveable tracking. The actual pod would be mounted along the centerline on the bot-

tom of the aircraft, and operated by a weapons system operator (WSO) in the back seat of the aircraft. This would preclude the use of a centerline mounted auxiliary fuel tank, necessary for long-range operations. Consequently, the OV-10 fuel system would be modified so that the aircraft could carry a drop tank on each wing for added range and endurance. The aircraft would also be equipped with a LORAN navigational device for more precise navigation. In a truly innovative move, the engineers created a way for the LASER system to “talk” to the LORAN and determine the coordinates of the target being designated by the LASER.<sup>5</sup>

Once the technical concept was accepted, Seventh Air Force planners decided that the OV-10s would be assigned to the 23d TASS at Nakhon Phanom. The Project would be called PAVE NAIL. The 23d TASS would use the system as another illuminator asset for the delivery of the PAVEWAY bombs. In addition, the PAVE NAIL FACs would also use the system to search for trucks, supplies, and personnel along the Trail.

In parallel with this development, several dozen F-4s were upgraded with LORAN navigational systems. This allowed them to perform bombing against targets in instrument meteorological conditions, accurately drop electronic sensors along the HCMT, or to steer to coordinates provided by the PAVE NAILS. The program was called PAVE PHANTOM.<sup>6</sup>

In November 1970, two OV-10s were flown to Eglin AFB, Florida, and modified with the systems which were actually built by the Ling, Temco, Vought Corporation (LTV), in Dallas, Texas. Sixteen missions were flown and six inert PAVEWAY modified bombs were delivered with LASER guidance. The average miss distance was twenty-five feet. The system worked. The deliver coordination procedure which was developed from the test was straightforward:

*The [PAVE NAIL] Weapons Systems Operator, using the Pave Spot system, acquires the target through the observation device. He then designates the target with the LASER. This gives a readout of LORAN target coordinates, elevation of the target, and the slant range to the target. The pilot then passes the LORAN coordinates and the elevation of the target to the ... F-4, who in turn feeds this information into his LORAN bombing system. Run-in headings and timing are agreed upon; and, ten seconds prior to bomb release, the [WSO] begins to LASER designate the target for bomb acquisition and guidance.<sup>7</sup>*

In July 1971, four modification kits were shipped to Clark Air Base, Philippines, and four 23d TASS OV-10s were so modified. The aircraft were then flown to Ubon Air Base, Thailand, where the 23d TASS maintained an operating location which focused on operations over Cambodia. There, Lt. Col. Lachlan Macleay, a career fighter and test pilot, was specifically deployed to combat validate the concept. Working directly with the PAVEWAY experts in the 8th TFW, from July through



(Above left) Lt. Col. Lachlan Macleay, a great commander.

(Above right) Capt Rick Atchison. (Both photos courtesy of Rick Atchison.)



**SOON, THE PAVE NAILS WERE FLYING BOTH DAY AND NIGHT MISSIONS OVER THE INCREASINGLY DANGEROUS HO CHI MINH TRAIL.**

September, he and a small cadre of young officers from the 23d TASS flew the aircraft over northern Cambodia, and tested all of the systems. On August 15, a PAVE NAIL crew consisting of Lt. Col. Macleay and Capt. Rick Atchison successfully directed a LASER guided bomb on a bridge. Throughout the combat evaluation, 79.5 percent of the bombs hit within forty feet of the designated targets, and confirmed that the system would work in the hot, humid skies of Southeast Asia.<sup>8</sup>

With this favorable report, the four aircraft were moved up to NKP and began sustained combat operations over the heart of the HCMT as part of COMANDO HUNT VII, the current iteration of the multi-year interdiction campaign. A cadre of maintenance personnel from LTV was dispatched to the base to maintain the systems.

It was none too soon because intelligence sources indicated that North Vietnam was moving massive forces and supplies south along the HCMT to mount a multi-pronged invasion of South Vietnam in the very near future. Eleven more PAVE NAIL modification kits were shipped to the 23d TASS and used to upgrade a like number of aircraft over the next several months.<sup>9</sup>

On October 17, Colonel Macleay assumed command of the 23d TASS. Within weeks, he welcomed twenty-two navigator rated officers who would fly as the WSOs in the PAVE NAILS, and selected a dozen squadron pilots who would fly with them. After settling in, they immediately entered the training program established by Captain Atchison. Soon, the PAVE NAILS were flying both day and night missions over the increasingly dangerous HCMT. As the young pilots and WSOs gained experience with the new technology, Macleay challenged

them to explore the capabilities of the new devices to see what they could really do. The eager aviators took to the task with relish.

The HCMT area had been divided into nine different assigned sectors, with two sectors, four and five, further subdivided into A and B sub-sectors because of enemy activity. In addition to the NAILS, *Covey* FACs from the 20th TASS located at Da Nang and Pleiku Air Bases in South Vietnam also patrolled the HCMT. Both squadrons were assigned sectors to cover for specific periods, day and night.

Generally, the PAVE NAIL FACs would not perform sector duties unless there was no FAC assigned or available. Instead, they would sometimes be assigned specific targets to hit or would be available to any FAC who found a target which warranted the expenditure of a LASER guided bomb. The PAVE NAIL crews quickly got to know the geography of Laos. On several missions, Pave NAIL crews were also directed to fly to specific known key locations such as mountain passes, river fords, road intersections, etc., and use the LASER/LORAN to determine the precise coordinates of these positions. This data could then be used to target the PAVE PHANTOM F-4s when the weather precluded visual delivery of ordnance.

Before flying their missions, the PAVE NAIL crews would be briefed as to when aircraft with LGBs would be available. They had to make sure they had a worthwhile target. In addition to the LORAN delivery procedure initially developed to facilitate the coordination between the PAVE NAIL and delivery F-4, the FAC crews developed a simpler protocol for the weapons delivery if they had good visual conditions and the fighters could see the target. In these conditions, the PAVE NAIL would

The PAVE SPOT turret.  
(Photo courtesy of Rick  
Atchison.)



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ask another FAC to fire a smoke rocket to identify the target for the fighters. The PAVE NAILS could do this themselves, but they had to stow the PAVE Pod, a time consuming process. Once the fighters had acquired the target visually, the PAVE NAIL would set up his orbit so that the WSO could then illuminate it and the fighters could roll-in and drop the bombs. When the fighter crew would call "pickle," the PAVE NAIL pilot would hack his clock, knowing that the bomb took about thirty-four seconds to drop from delivery altitude. Both the FACs and the F-4 crews who regularly worked with them became very adept at this procedure.

On one sortie in December in northern Laos, a Raven FAC asked a PAVE NAIL to put an LGB on a 130 mm field gun up on the Plaine De Jarres, in northern Laos. When the F-4s arrived, the Raven fired a rocket to identify it. When he and the PAVE NAIL were ready, the F-4 dropped a Mk-84 2,000 lb LGB. The bomb hit, but did not explode. The Raven was watching the target with binoculars and told them that they had killed the gun. The F-4 pilot protested that the bomb had not detonated. "Not important," the Raven replied, "it's dead." The bomb had actually hit the gun, and the physical energy of that 2,000 lb projectile had completely smashed it into pieces.<sup>10</sup>

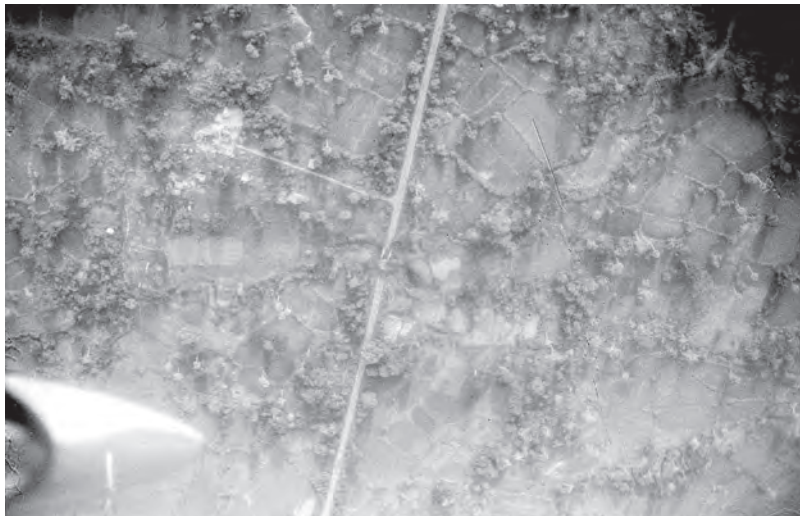
Below, all along the HCMT, the North Vietnamese forces were constantly active as they steadily moved their supplies south for the planned offensive. U.S. air power continued to bomb the road system and troops and supplies traversing it. To protect them, the enemy steadily increased its air defense forces, a fact validated by the steady toll of aircraft shot down.

U.S. Air Force rescue helicopters and escort

A-1s, also stationed at Nakhon Phanom, were trained and ready to rescue the downed crews. All aircrews had to be prepared at any moment to initiate or run a search and rescue (SAR) operation, especially the FACs because they were always at risk, as were the aircraft they were directing against the enemy targets. The 23d TASS provided specific focused training in SAR procedures for all of its aviators. Recognizing that the unique capabilities of the PAVE NAIL aircraft could be very useful in SAR operations, Captain Atchison worked with several other PAVE NAIL personnel to develop specific tactics for their aircraft. There was no shortage of opportunities to test and validate them.

On December 10, an F-105 Wild Weasel, Ashcan 01 was shot down near the Mu Gia Pass. Both men ejected. NAIL FACs in the area rapidly responded. However, the weather was terrible, and precluded a quick recovery. Throughout the day and night, PAVE NAIL crews directly assisted by using their LORAN gear in conjunction with ADF cuts from the survivors radio to determine an accurate position for the one survivor with whom they had contact. Once that was known, LORAN equipped F-4s were able to deliver ordnance around the survivor to protect his position. The next morning, using the LORAN derived position of the survivor, a PAVE NAIL flown by Maj. Dick Harris and Capt. Cleon Blankenbeker led the rescue helicopter down through the weather to make a successful recovery of the backseater. While below the clouds, the helicopter crew saw the body of the pilot hanging lifeless in his harness entangled in high trees. They were not able to recover the body.<sup>11</sup>

Seven days later, an F-4 went down at night, again in the Mu Gia Pass. PAVE NAILS immedi-



(Above left) The first PAVE NAIL test target in Cambodia.

(Above right) The test bridge through the PAVE SPOT scope. (Both photos courtesy of Rick Atchison.)

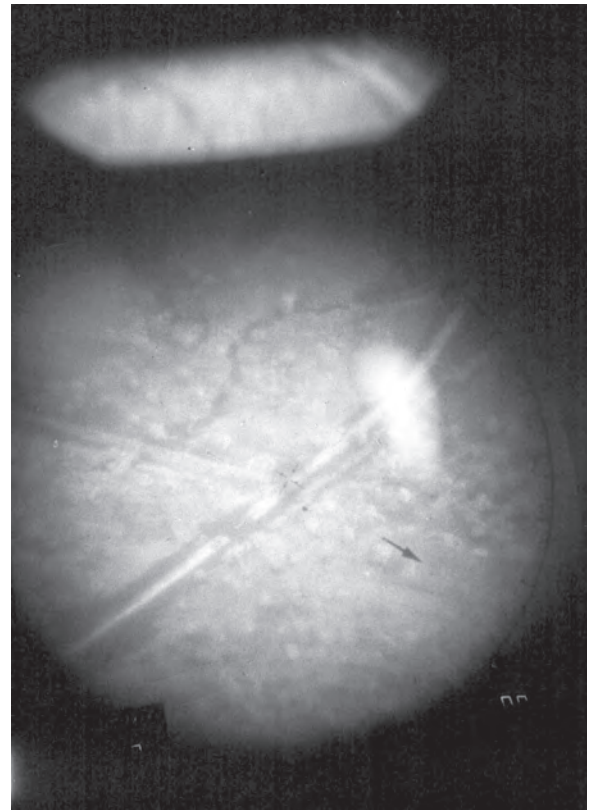
**COMMANDERS AT SEVENTH AIR FORCE WERE NOW DEEPLY CONCERNED ABOUT THE EXPANSIVE GROWTH OF ENEMY DEFENSES... THEY DECIDED TO INITIATE A FOCUSED CAMPAIGN AGAINST THE AAA GUNS**

ately initiated a search. One crew, Captains Rocky Smith and Rick Atchison, made radio contact with the survivors and instructed them to turn on infrared strobes which they carried. When they did, Atchison was able to find them with the PAVE SPOT and determine their precise locations. Both men were picked up by HH-53s from NKP. This brilliant tactical innovation was rapidly accepted as a useful technique for SARs, and dramatically identified the PAVE NAIL and its crews as key elements in combat recoveries.

The next night, three F-4s were shot down, this time far to the north, near Bartholome Pass, in an air-to-air battle with North Vietnamese MiG 21s. Again, the weather was very poor, and that far north, there were no useable navigational aids—except LORAN. The PAVE NAILS launched for SAR duty again. A crew of Captains Ian Cooke and Robert Wikstrom flew into the area and located the crew of Falcon 72. But a rescue attempt had to wait until sunrise. During the night, PAVE NAILS rotated in and out to maintain cover over the survivors. Several times they had to take evasive action from attacking MiGs. The PAVE NAILS also directed LORAN deliveries of area denial ordnance around the survivors which prevented their capture.

Back at Nakhon Phanom, continuous planning was underway to develop an approach to the survivor's locations through the bad weather. It had to be carefully done because the men were down in deep valleys. Intelligence supplied three-dimensional maps of the area. Using the precise LORAN coordinates of the survivors, Captain Cooke and 1st Lt. Dave Talley were able to lead a rescue task force of helicopters and A-1s down through the weather. The tactic worked and both men were rescued. Once again, the PAVE NAILS were lauded for the critical new capabilities that they brought to the SAR mission.

But that also had its drawbacks. All fifteen PAVE NAILS were now regularly being fragged against the HCMT, and the crews were being stretched to their limits. But SARs, when they randomly happened, completely changed the schedule, and crews had to be constantly ready. It was a very stressful time.



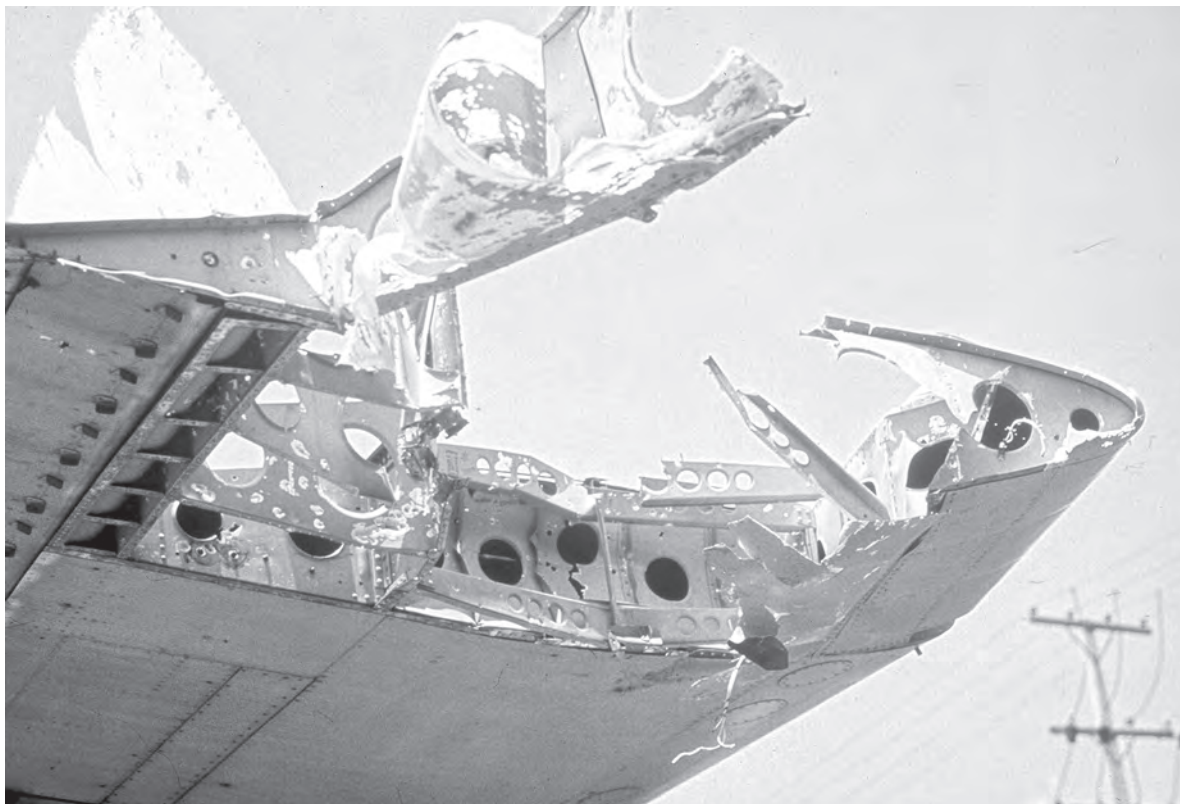
On December 26, the NAILS lost one of their own. NAIL 30, Capt. Lynn Guenther, was shot down near Ban Karai Pass by AAA. Other NAILS immediately responded, but he had been taken by the enemy, and would not be released until 1973.<sup>12</sup>

As 1972 started, commanders at Seventh Air Force were now deeply concerned about the expansive growth of enemy defenses along the HCMT. They decided to initiate a focused campaign against the AAA guns. The project labeled "The Recce Gun Kill Program" would integrate intelligence data collected in near real time from radio intercept and photo assets to locate clusters of guns. Reconnaissance aircraft would then photograph the actual gun pits, and snap-shot copies of them with LORAN coordinates would be provided to, among others, the PAVE NAIL crews. Loaded with that information, they would hit those sites with LGBs. Daily, a T-39 would arrive at NKP from Udorn Air Base, the home of the photo reconnaissance RF-4s, and off-load a bundle of the latest pictures of gun sites.

This program went on for several months. According to photo analysis, only thirty of the 252 guns identified were confirmed as actually destroyed—not great numbers. But there was no way to tell how the gun crews themselves fared. Additionally, the non PAVE NAIL FACs also carried the photos and went after the guns. Squadron records show that from January through March, NAIL FACs attacked 237 AAA sites and claimed eighty-two destroyed, consisting of 23 mm, 37 mm, 57 mm, 85 mm, and 100 mm guns. During this same period, they also directed 767 major road cuts, and damaged or destroyed more than 300 trucks and bulldozers.<sup>13</sup>

However, as the PAVE NAILS accumulated





FLYING AS MUCH AS THEY DID OVER HEAVILY DEFENDED AREAS, IT WAS INEVITABLE THAT A PAVE NAIL WOULD BE SHOT DOWN

ON MARCH 30, 1972,... NORTH VIETNAM UNLEASHED THEIR EXPECTED MASSIVE INVASION INTO SOUTH VIETNAM

combat hours, the limitations of the system became apparent. Whereas the precision capability of the system to guide LGBs and determine precise coordinates had been validated, the system could not solve the fundamental problem of the HCMT—the initial finding of the trucks, supplies, and enemy units. The PAVE SPOT system had too narrow a field of view for any type of useful searching. The PAVE NAIL FACs would use the classic FAC technique of searching with binoculars. But when they would find something, they would frequently have great difficulty talking their WSOs onto the target with the PAVE SPOT. Additionally, the system had two filters - one for day, and one for night. They could only be changed by the LTV personnel on the ground. Additionally, both filters had a tendency to blank out for a short period of time at sunrise and sunset.<sup>14</sup>

This dilemma was exacerbated by the actions of the enemy. After years of being pummeled by allied air power, they had learned the value of good camouflage. Whole sections of the massive road complex were very effectively covered from view. The PAVE NAIL could not solve that problem.<sup>15</sup>

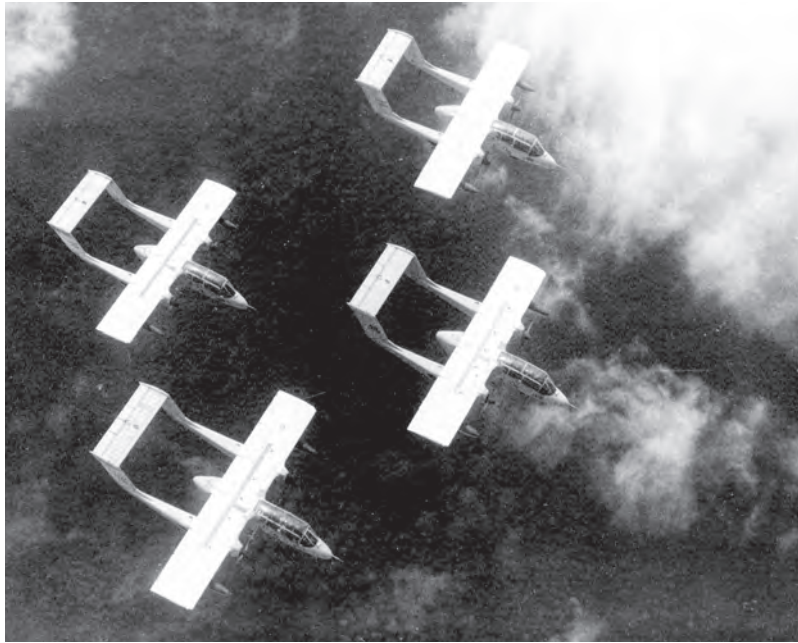
Flying as much as they did over heavily defended areas, it was inevitable that a PAVE NAIL would be shot down. On March 18, 1972, 1st Lt. Dave Breskman and Capt. Steve Boretsky, call sign NAIL 31, were directing an air strike near a prominent interdiction point in Central Laos known as the *Catcher's Mitt* when the aircraft was struck by several rounds of enemy AAA. They ejected and landed several hundred meters apart. For the next twenty-four hours, rescue forces led by other NAIL FACs and A-1 Sandys also from NKP, battled with enemy forces in the area before the two men were

picked up by an HH-53 *Jolly Green*. In the melee, an A-1 was also shot down. That pilot was also rescued. At one point, Breskman had encountered an enemy soldier. The man was armed with an AK-47, and the pilot had to kill him to keep from being captured. Breskman kept his AK-47 as a souvenir.<sup>16</sup>

Ten days after the NAIL 31 crew rescue, an AC-130 *Spectre* gunship was blown out of the sky by an SA-2 surface-to-air missile (SAM) launched from a site not too far north of the *Catcher's Mitt*. All fourteen airmen aboard were killed. NAIL FACs and others swarmed overhead, but there was nothing to do for the lost crew. However, every suspected enemy position in the area was heavily bombed.

Just two nights later, another *Spectre* gunship working over the HCMT was shot out of the sky, this time by AAA fire. Fortunately, all fifteen crewmembers were able to bail out before the aircraft went down. However, they were scattered over a thirty-seven mile area, and two of them were near enemy forces. First on the scene was a PAVE NAIL crew, NAIL 37, Capt. Pete Morelli and 1st Lt. Vic Gedris. They immediately began locating the survivors using their LORAN and radio direction finding capability. Throughout the night PAVE NAILS, other NAIL FACs, and A-1s located all personnel. The next morning, *Jolly Greens* were able to recover all of the downed airmen.<sup>17</sup>

On March 30, 1972, literally as the *Spectre* gunship recovery was concluding, North Vietnam unleashed their expected massive invasion into South Vietnam. Initial battles took place along the Demilitarized Zone (DMZ) which separated the two countries, and then spread to other fronts in central and southern South Vietnam. Over the next several days, the DMZ attack developed into a fierce battle



Four PAVE NAILS in formation.

**THE NORTH VIETNAMESE FORCES KNEW THAT THEY WOULD BE ATTACKED BY ALLIED AIR POWER AND WERE PREPARED TO DEFEND THEIR FORCES**

**AS U.S. AIR POWER SHIFTED TO RESPOND TO THE ENEMY OFFENSIVE...THE AIR CAMPAIGN AGAINST THE HCMT WAS REDUCED**

between a multi-divisional North Vietnamese force equipped with modern Soviet artillery, tanks, supplies, and air defense weapons to include SA-2 missile batteries, and the defending South Vietnamese forces. The enemy advanced under a persistent cover of low clouds. To provide for all weather bombing, PAVE NAILS were sent into the battle, initially to collect LORAN coordinates of key interdiction points, and then to direct LGBs. At one point, NAIL 25, a PAVE NAIL crew of Captains Rocky Smith and Rick Atchison, was working south of the DMZ when, through a break in the clouds, they spotted large numbers of vehicles of all types. They thought that the vehicles were from South Vietnamese units until they noticed the red stars painted on them. Then the enemy gunners opened up with a huge variety of weapons to include SA-2 surface to air missiles. The North Vietnamese forces knew that they would be attacked by allied air power and were prepared to defend their forces with the accompanying strong air defense element. They called it the *Meatgrinder*.<sup>18</sup>

On April 2, those air defenses downed several allied aircraft to include an EB-66 electronic reconnaissance aircraft, call sign Bat 21. One man ejected from that aircraft, the navigator, Lt. Col. Iceal Hambleton. He was down in the midst of the invading force of 30,000 troops engaged against a like number of South Vietnamese. Once again, the PAVE NAILS were called upon to perform SAR duties and began flying sorties in the lengthy mission, destroying enemy forces and guns, and plotting the locations of the survivors, key road junctions, and enemy units.

The next day, while orbiting above Hambleton, NAIL 38, a PAVE NAIL crewed by 1st Lts. Bill Henderson and Mark Clark, was hit by an SA-2 missile and downed just west of Dong Ha, South Vietnam. Both men ejected and also floated down into the huge land battle consuming the region. Clark was just along the south bank of the main

river running through the area, and about one kilometer east of Hambleton. Henderson was two kilometers north of Clark. Both found excellent hiding places and were able to use their survival radios to make contact with FACs above. Unfortunately, that night an enemy force moved into the area around Henderson and he was captured. He was subsequently moved north to Hanoi and released ten months later.

Clark was able to remain hidden. For the next several days, under the cover of massive air strikes, rescue forces tried to get in to both survivors, but were beaten back by the strong enemy units. Twice, Clark was doused with chemical agents that were dropped to prevent the enemy from capturing him. On April 6, a *Jolly Green* made an attempt to pick up Clark and Hambleton. Unfortunately, the massed enemy guns in the area were able to shoot it down. It crashed just a few hundred yards from Clark's position. All six crewmembers aboard were killed. Four days later, a small team consisting of a U.S. Marine, a Navy SEAL and a South Vietnamese Commando, were able to work their way through the enemy lines to rescue Clark and eventually Hambleton. It was the most dramatic rescue of the entire war.<sup>19</sup>

Initially the FACs from the 20th TASS at Da Nang supported the South Vietnamese forces along the DMZ. However, as the battle expanded, the 23d TASS was directed to deploy several FACs and PAVE NAILS to Da Nang to reinforce them. When the North Vietnamese intensified their strong attacks in the Central Highland region of South Vietnam and north of Saigon, PAVE NAILS deployed to Pleiku and Tan Son Nhut ABs to reinforce the FACs supporting the South Vietnamese forces engaged there. The PAVE NAIL crews became very adept at delivering LGBs close to friendly troops.

As U.S. air power shifted to respond to the enemy offensive, and then ultimately to operations again over North Vietnam, the air campaign against the HCMT was reduced. In April, the 23d TASS flew 357 sorties over the HCMT. By June, that monthly total was down to thirty-one. On June 2, Colonel Macleay, the *godfather* of the PAVE NAIL program handed over command of the 23d TASS and returned to the United States. He was succeeded by Maj. Max Brestel. He oversaw the installation of AN/APR-25/26 Radar Homing and Warning (RHAW) gear on first the PAVE NAIL aircraft, and then all OV-10s. It gave them critical early warning if an SA-2 missile radar was tracking them.<sup>20</sup>

Three days later, the PAVE NAILS were assigned SAR duty again when Cosmic 16, an RF-4, was shot down twelve miles west of Dong Hoi in North Vietnam. The pilot was captured. The WSO was located at night by PAVE NAILS. The next morning, another PAVE NAIL crew, call sign NAIL 40, led a force of A-1s and *Jolly Greens* across Laos into the dangerous flatlands near Dong Hoi to successfully recover the survivor. The PAVE NAIL aircraft was the only one from the rescue force hit by



"The Dog's Head" interdiction point.

## THE 23D TASS CONTINUED TO OPERATE OUT OF DA NANG UNTIL JANUARY 28, 1973, WHEN THE CEASE-FIRE ... TOOK EFFECT

the enemy guns. It sustained minor damage from one round of small arms fire in the tail section. PAVE NAILS were now a routine part of rescue operations in every part of Southeast Asia except around Hanoi.

Two days after the Cosmic 16 mission, Vampire 50, a QU-22 electronic collection aircraft, was downed by thunderstorm activity in southern Laos. The pilot bailed out, again, near the Catcher's Mitt. NAIL 28, a PAVE NAIL crewed by 1st Lts. Jennings Pewthers and Bill Barron, flew into the area, located the survivor, and determined his precise location with their LORAN. They were then able to rendezvous with an Air America rescue helicopter and guide him directly to the survivor. The whole operation took three hours.<sup>21</sup>

Sometimes the PAVE NAIL crews got a little adventurous. One night, there was not much going on along the HCMT, so one of the crews went looking for trucks near Mu Gia pass. The found quite a few on the east side of the pass and requested air support. Several Navy fighters responded. For the next half-hour they directed them against several convoys, and did quite a bit of damage to the enemy forces. They also noted that enemy AAA fire was very heavy. The crew thought that it was just the normal enemy reaction to air strikes in that area. However, as the last flight of Navy fighters was departing the area, the flight lead complimented the crew for their bravery. The PAVE NAIL crewmembers were taken aback by the comment when the flight lead continued, "Yeah, I sure wouldn't fly over Mu Gia Pass with my landing light on." The crew was spotted at breakfast the next morning. The pilot had a noticeable red welt on his left cheek and the WSO had a sore right hand.<sup>22</sup>

On September 17, 1972, a third PAVE NAIL was lost. NAIL 60 consisting of 1st Lt. Ron Kuhl and Maj. Al Bowers were flying from NKP to Da Nang on a ferry/supply flight. While crossing Laos, they lost an engine and could not maintain level flight. Rescue forces were alerted. They ejected along the

South Vietnam—Laos border, near the A Shau Valley. NAIL 36, Capt. John Sundgren, covered them until A-1s and Jolly Greens were able to recover them. Bowers broke his back and was medevaced home. The aircraft was destroyed.<sup>23</sup>

The 23d TASS continued to operate out of Da Nang until January 28, 1973, when the cease-fire directed by the Paris Peace Accords took effect. A few days later, all 23d TASS aircraft and personnel were returned to NKP, and stepped up operations over the HCMT were resumed.<sup>24</sup>

The HCMT saw a resurgence of use as the North Vietnamese rushed supplies to their savagely decimated units in the south. Before the cease-fire took effect in Laos on February 22, the NAILS flew another 1,142 sorties (both conventional OV-10 and PAVE NAIL) over northern and southern Laos and increasingly over Cambodia. The combined bomb damage claimed by all NAILS included 113 trucks damaged or destroyed, twenty-two tanks damaged or destroyed, seven 130 mm field guns damaged or destroyed, eight AAA guns destroyed, forty-four road cuts, and fifteen caves collapsed. However, as the squadron closed out operations in Laos, it was becoming increasingly obvious that operations would increase in support of friendly forces in Cambodia.<sup>25</sup>

The next month, the 23d TASS shifted its operational focus to Cambodia. Major squadron operations moved to Ubon AB, Thailand, where the NAILS joined the 23d TASS Rustic detachment located there, which had been the long-term FAC force supporting the Cambodian forces. Operating out of Ubon, and refueling at Ponchetang Airport, Phnom Penh, Cambodia, the Rustic and NAIL FACs logged as many as thirty-eight missions a day, providing classic FAC support to the Khmer Military units located primarily in the center and south of the country. They also flew long range interdiction against extensions of the HCMT which extended into northeastern Cambodia. As before, the PAVE NAILS were used for key target precision location and LGB target illumination. They were also available for SAR support as necessary.

The most harrowing and demanding mission for the 23d TASS crews was convoy escort for supply ships coming up the Mekong River to Phnom Penh. All were covered by FACs. Falling back on an old tactic from the HCMT, recce aircraft photographed enemy gun positions along the river, and PAVE NAILS hit them with LGBs.

Fortuitously, the enemy forces in Cambodia were not as heavily equipped and armed as the North Vietnamese forces in Laos or South Vietnam during the Easter offensive, and there were few targets which justified the use of LGBs. Consequently, the PAVE NAILS were increasingly utilized as basic FACs until the American unilateral cease-fire mandated by the U. S. Congress took effect in Cambodia on August 15, 1973. On that date, the NAILS ended over seven years of continuous combat operations, shut down the Ubon operation, and returned to NKP.

Training programs were immediately upgraded

AAA gun killed with an LGB.



**SEVENTH AIR FORCE STAFF, IN ITS REVIEW, DETERMINED THAT THE PAVE NAIL WAS NO LONGER NEEDED IN THE THEATER**

to insure that all FACs maintained combat readiness for any possible resumption of hostilities. Practice SAR missions were organized and run with participation of rescue units. The PAVE NAILS were key participants in all of these exercises. Additionally, the 23d TASS sponsored a theater tactics conference and the PAVE NAIL crews led the discussions on SAR tactics and procedures.

But a steady drawdown in personnel, projected aircraft redeployments, a dramatic reduction in aviation fuel availability, and the high cost of contractor maintenance personnel led to a directive from headquarters to the 23d TASS to conduct an analysis of the viability of continuing the PAVE NAIL system. This analysis took place in November. It determined that:

Civilian contract support for LTV was very expensive, and the contract was set to expire.

Other LASER designation systems were now available in the theater sufficient to meet projected needs and at lower risk.

The OV-10 aircraft was a slow moving aircraft restricted to low to medium threat arenas.

In residual operations in Cambodia, the PAVE NAILS had limited targets suitable for LGBs. Most were used in traditional FAC roles.

The Role played by PAVE NAILS in SAR operations could be performed by OV-10s with LORANs.

Recent developments in missile technology by adversaries indicate that the survivability of the OV-10 may be decreased.

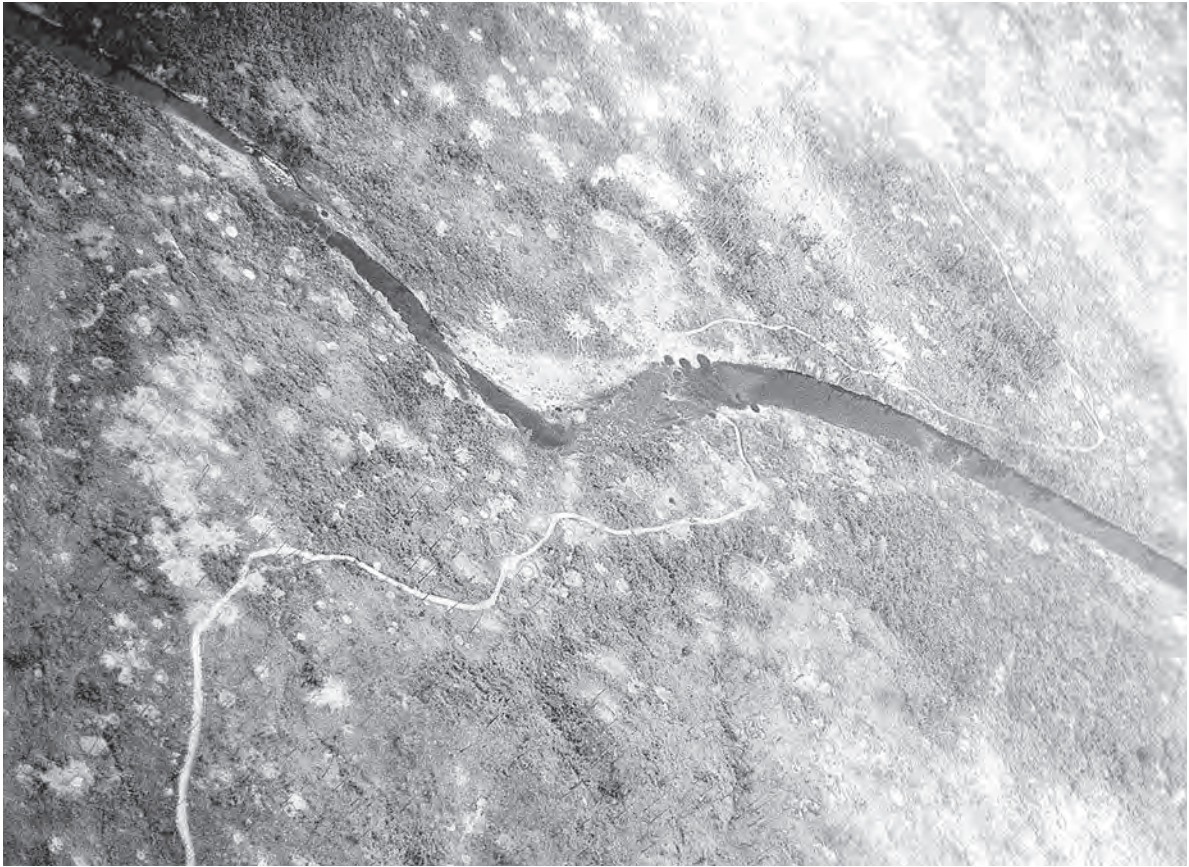
PAVE NAIL experience is of limited value to young rated navigators who serve as the WSOs.<sup>26</sup>

Based on these conclusions, the 23d TASS commander, Lt. Col. Howie Pierson, recommended that the PAVE SPOT Pods be removed, the LORAN systems be retained, and the wing fuel tanks also be retained so that with the remounting of a centerline fuel tank, the aircraft would have an un-refueled endurance of over eight hours.

The Seventh Air Force staff, in its review, determined that the PAVE NAIL was no longer needed in the theater. It directed that the program be completely terminated. The squadron continued to fly them and train the crews. However, in May and June 1974, the twelve remaining PAVE NAIL aircraft were stripped of their PAVE SPOT gear and LORAN navigation systems and returned to standard configuration. Several of the aircraft were shipped to other theaters, and many of the pilots and all of the WSOs were sent home.<sup>27</sup>

PAVE NAIL had a relatively short life of just three years. Reviews of the program were mixed. The aircraft did provide critical LASER guidance capability when it was sorely needed, although the PAVE SPOT system was not effective for spotting trucks and supplies along the HCMT. The aircraft itself, though, was the main limitation; its twenty percent loss rate indicated that it could not survive in a high threat area. However, it was an innovative combination of new technologies which created an ability to precisely determine the coordinates of a position on the ground. That advance had implications well beyond target destruction. It gave our forces the ability to quickly and accurately locate key target locations and downed aircrew. Many men

A classic river crossing interdiction point.



## PAVE NAIL HAD A RELATIVELY SHORT LIFE OF JUST THREE YEARS

were rescued in those late days of the war because of that innovative use by those hard charging young aircrews. PAVE NAIL played a small part in the beginning of the precision weapons revolution. However, in its own simple way, it allowed airmen to do what they do best - harness technology for purposes well beyond its initial design. In the wan-

ing days of our involvement in the long war in Southeast Asia, the young PAVE NAIL crews, through their innovative and creative efforts, made their own singular and distinctive contributions to the evolution of precision warfare, fully brought to fruition in later conflicts in Iraq, Bosnia, and Afghanistan. ■

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# Early Experimental Guided Missiles





Jacob Neufeld

(Overleaf) The JB-10 on its trailer.

(Right) Lt. Col. Henry H. "Hap" Arnold.

## THE AVIATION SECTION OF THE SIGNAL CORPS FIRST BECAME INVOLVED WITH MISSILES SHORTLY BEFORE AMERICA'S ENTRY INTO WORLD WAR I WHEN IT SPONSORED CHARLES F. KETTERING'S RESEARCH ON A REMOTELY CONTROLLED AIRCRAFT



The Aviation Section of the Signal Corps\* first became involved with missiles shortly before America's entry into World War I when it sponsored Charles F. Kettering's research on a remotely controlled aircraft dubbed the "Bug." A renowned engineer, Kettering collaborated on the project with several associates, including Orville Wright, Elmer A. Sperry, Edwin S. Votey, and Childe H. Wills. Also called a flying bomb, an

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Excerpted from Jacob Neufeld's *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, D.C.: Office of Air Force History, 1990), pages 8 to 13, this essay aims to provide background to more advanced laser-guided bombs and laser guns.

\* Established on August 1, 1907, the Aeronautical Division (Signal Corps) became the Aviation Section (Signal Corps) on July 18, 1914. The Air Service was created in May 1918.

aerial torpedo, and Project Liberty Eagle, the small craft was built by the Dayton Metal Products Company. It performed well enough after several test flights for the Air Service to order 100 of the pilotless aircraft in October 1918. Col. Henry H. "Hap" Arnold, another of those involved in the project, wanted to persuade Gen. John J. Pershing, Commander of the American Expeditionary Forces, to organize tactical missile units in Europe. Unfortunately for missile enthusiasts, Arnold became ill and before he could see General Pershing the war had ended. With the cessation of hostilities, production was canceled and the project abandoned. The Navy, which had started a similar program in 1916, continued its research until about 1919, but then it too scrapped the work.<sup>1</sup>

In 1923, the Chief of the Air Service Engineering Division at McCook Field, Ohio, recommended adapting radio controls to the aerial torpedo and the following year obtained support for the

*Jacob "Jack" Neufeld is the editor of Air Power History and a consultant. Before his retirement from federal civil service in 2006, he was Director of the Air Force Historical Studies Office. During his forty-year career, he held virtually every senior position in the Office of Air Force History from staff historian to branch chief to senior historian to general editor. From 1992 to 1994, he was the Director of the Center for Air Force History. Neufeld earned BA and MA degrees in history at New York University and did doctoral studies at the University of Massachusetts, Amherst. Commissioned in the U.S. Army, he served with the Corps of Engineers from 1964-1966. He has written and edited numerous works in military history and the history of technology, including Development of Ballistic Missiles in the United States Air Force, 1945-1960. He also wrote several biographical studies of General Bernard A. Schriever, the "father of the USAF missiles and space programs." Neufeld was an adjunct professor of history at the University of Maryland, Montgomery (Md.) College, and American Military University.*



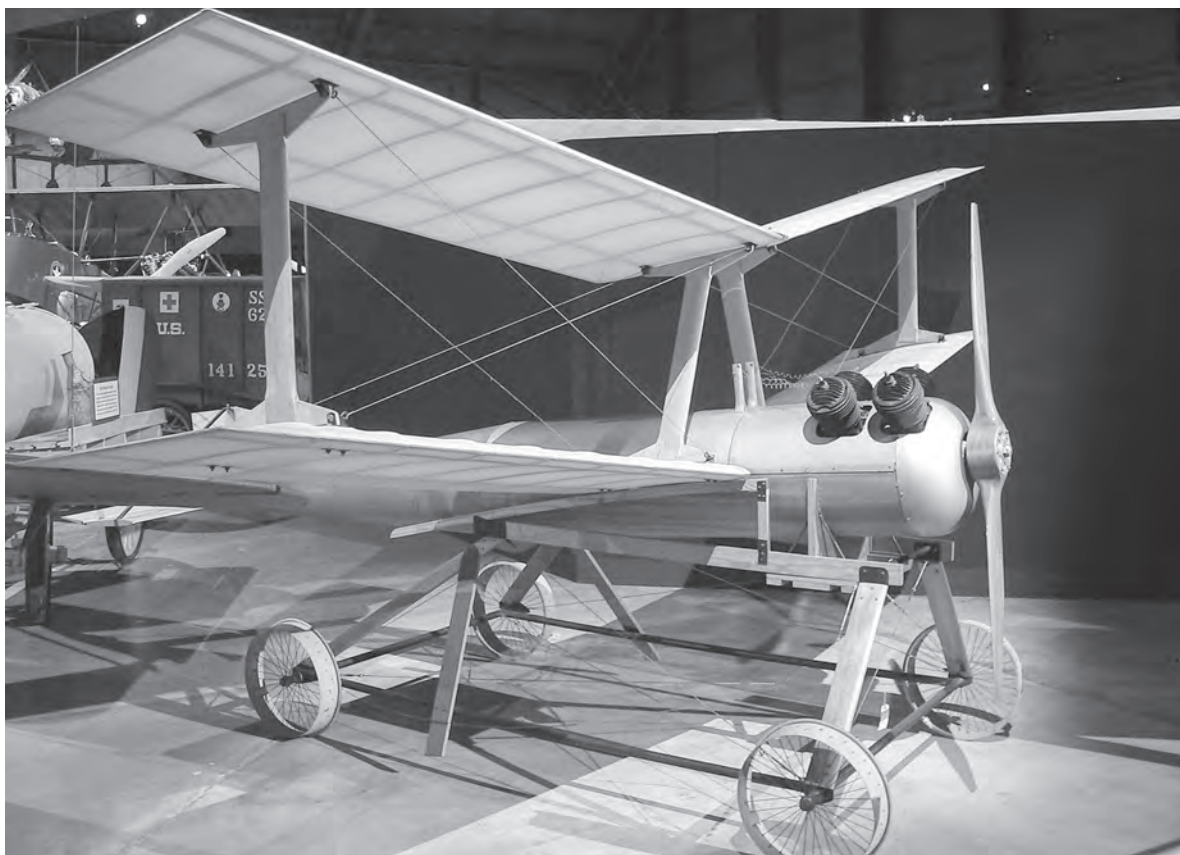


however, the effort fountered in 1932 and then lay dormant until the eve of World War II.

Interest was next renewed with the August 1937 demonstration of a completely automatic radio-controlled flight and landing of an aircraft.<sup>†</sup> This event prompted Maj. Gen. Oscar Westover, Chief of the Air Corps,<sup>‡</sup> to establish a requirement for an unmanned aircraft with a range between 20 and 50 miles, carrying 200 to 300 pounds of explosives and capable of striking a two square-mile target. A design competition was initiated in April 1939, but failed to elicit an acceptable proposal. Nonetheless, the effort resumed in February 1940, with even more demanding specifications for the aircraft to fly up to 100 miles and strike within one-half mile of a target.

This phase culminated in April 1941, when Charles Kettering, now a General Motors Corporation executive, won a contract to fabricate ten aerial torpedoes. Designated as Guided Missile A-1 (GMA-1), or "controllable bomb, power-driven," the project was supervised by Col. George V. Holloman, Chief of Air Materiel Command's Special Weapons Unit at Wright Field, Ohio.<sup>2</sup>

The Kettering Aerial Torpedo, on display at the National Museum of the U.S. Air Force.



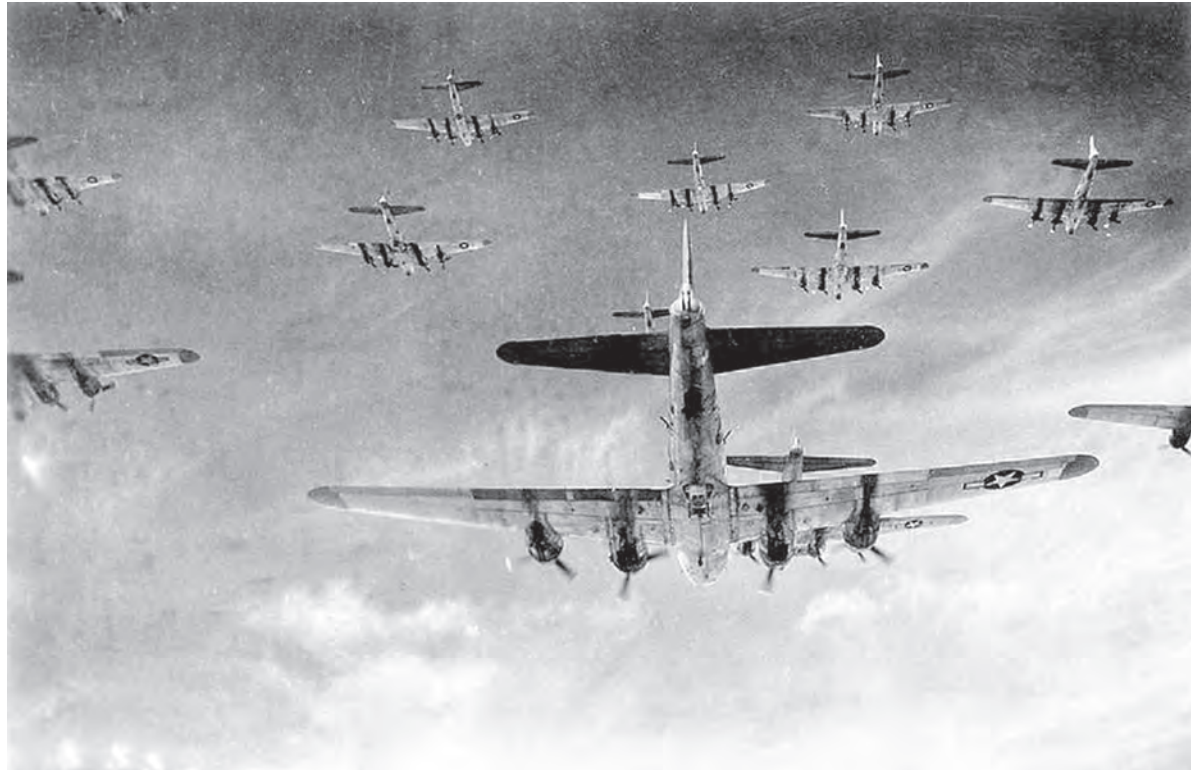
**DESPITE SUCH SIGNAL ACHIEVEMENTS AS PRESET FLIGHTS TO A DISTANCE OF 30 MILES AND RADIO-CONTROLLED FLIGHTS OF UP TO 90 MILES, THE PROJECT WAS CANCELED A SECOND TIME FOR A LACK OF FUNDS**

project. Despite such signal achievements as preset flights to a distance of 30 miles and radio-controlled flights of up to 90 miles, the project was canceled a second time for a lack of funds. It was revived in 1928, as part of a scheme to adapt remote control and guidance, with various-sized bombs, to commercial aircraft and to file the data for future reference in the event of war. After a promising start,

<sup>†</sup> Capt. George V. Holloman, Capt. Carl J. Crane, and Raymond K. Stout developed the automatic landing system and flew aboard the test aircraft on its historic flight.

<sup>‡</sup> The Air Corps was established on July 2, 1926.

B-17s like these, although war-weary and obsolete were used as remote-control bombs.



**A MORE PROMISING APPROACH, BEGUN IN 1944, INVOLVED THE USE OF OBSOLETE B-17 AND B-24 AIRCRAFT AS POWER-DRIVEN BOMBS, NICKNAMED WAR WEARY**

The new Bug was expected to carry between 2,000 and 4,000 pounds of explosives over a pre-selected 20-mile range and then dive into its target. The Special Weapons Unit grappled with the requirement for about two years without appreciable success and was especially stymied by the craft's inaccuracy. Moreover, during the course of the war, the Bug's capabilities in terms of speed, range, and bomb load seemed increasingly inadequate as the capabilities of standard combat aircraft increased. Consequently, in August 1943, the AAF\*\* considered other small, power-driven pilotless aircraft for special bombing missions, including the Fleetwings XQB-1 and XQB-2 and the Fairchild XQB-3. But these conventional aircraft also proved inadequate because they were expensive, needed clear visibility, fighter protection, and highly skilled crews.<sup>3</sup>

A more promising approach, begun in 1944, involved the use of obsolete B-17 and B-24 aircraft as power-driven bombs. Nicknamed War Weary, the project employed a large number of these aircraft. On a typical mission, the pilot would take off in an airplane laden with about 20,000 pounds of explosives, set a course, and then bail out. (Navy Lt. Joseph P. Kennedy, Jr., President John F. Kennedy's older brother, died on such a mission when the bomb load exploded prematurely.) War Weary aircraft carried a predetermined fuel load to stop the engines over the target. The bombers could also be controlled by accompanying "director" aircraft or from the ground. Like the Bug, these experimental aircraft were beset by serious problems in accuracy and therefore proved most useful against large area targets.<sup>4</sup>

\*\* The AAF was created on June 20, 1941.

Another category of missiles developed during the war included the air-launched glide bombs (GB), which had numerical designations from 1 to 15. Interest in these weapons stemmed from the work done by the British, and from General Arnold's 1941 directive to the AAF to develop them. The glide bombs were simply standard 1,000-, 2,000-, and 4,000-pound bombs fitted with wings and gyro-stabilizers. The GB-1, for example, was a general-purpose bomb to which was attached a simple monoplane structure, including a wing assembly with twin booms extending rearward to a horizontal surface with two square fins and a movable elevator. Most glide bombs were preset on a course and could not be controlled after being released from their aircraft.

Although these missiles experienced problems in achieving acceptable accuracies, the AAF was determined to prepare them for combat. The effort began in October 1942, and by the end of 1943 the GB-1 and its B-17 launch aircraft were declared ready. The initial combat mission, however, was not flown until March 25, 1944, when a squadron of 58 B-17s, each carrying two GB-1s, attacked Cologne. Fewer than half the bombs hit their intended targets, and the Eighth Air Force, noting that manned bombers could do better, gave up on the project. At war's end the AAF had 200 glide bombs in storage, but did not plan any further research with them.<sup>5</sup>

A variant of the GB series was the air-launched glide torpedo, which involved the AAF and Navy in a dispute over which service should develop it. The AAF also experimented with the radio-controlled and television-guided GB-8 missile. While the AAF encountered accuracy problems with the GB-8, the Navy used a similar missile, called the Bat, with some success. The AAF also experimented with a



The VB-1 Azon.

**THE AAF ALSO EXPERIMENTED WITH A LARGER BOMB, THE TELEVISION- AND RADIO-GUIDED GB-4 ...WITH GENERALLY DISAPPOINTING RESULTS**

larger bomb, the television- and radio-guided GB-4. Between July and September 1944, the GB-4 was launched against German U-boat pens at Le Havre, France, with generally disappointing results.<sup>6</sup>

Another category, called high-angle or vertical bombs (VB series), also consisted of standard-size bombs equipped with special controls. Developed by the National Defense Research Committee, the apparatus was mounted in a square-shaped tail at the rear of the bomb. Also included on the tail were a flare, radio receiver, antenna, gyrostabilizer, and rudders. Launched from B-17 aircraft, the vertical bombs were controlled through part of their earthward dive by the bombardier. The most useful of these weapons-and the only one used in combat in more than experimental quantity-was the Azon (VB-1) missile. Azon (short for azimuth only) was a 1,000-pounder that could be controlled to the right and left of a target and, therefore, effective in attacking roads, tunnels, bridges, and railways. The first Azon model appeared in 1943, and 150 of the missiles were initially ordered for testing. Test results proved so encouraging that the AAF placed quantity orders for the missile.

In early 1944, a specially trained squadron attached to the Fifteenth Air Force in Italy unveiled the VB-1 in attacking the Brenner Pass and river locks on the Danube. Despite some early successes, Azon performed erratically in subsequent missions and saw only limited action in Europe during the

balance of the war. The weapon proved more successful, however, in the China-Burma-India Theater. In 1944 and 1945 the 7th Bombardment Group used Azon missiles to destroy nearly all of the bridges in Japanese-held Burma. During a two-month period, ten Azon-equipped B-17s destroyed 27 bridges with an expenditure of 459 missiles and had direct hits with 10 to 15 percent of the weapons<sup>7</sup>. At the end of the war there were 12,000 Azons on hand and another 10,000 on order. Nonetheless, the AAF abandoned Azon when it achieved better test results with more technologically advanced vertical bombs.<sup>8</sup>

Even as the AAF flew the Azon, the Massachusetts Institute of Technology (MIT) was devising a more advanced missile called the Razon (for range and azimuth). This 2,000-pound vertical bomb entered development in 1942, but was not ready for combat before the war ended. At that time the service had a stockpile of 3,000 Razon bombs.\* Other bombs in the VB series included the Felix (VB-6), a heat-seeking missile, and the Roc, a television-guided bomb with radio-controlled variants. The AAF also fitted television guidance to the 12,000-pound British Tallboy bomb; called the VB-13, it was used to attack German submarine pens.<sup>9</sup>

The most important category of pilotless aircraft developed by the AAF during the Second World War was the jet-propelled missile. In July 1944, one month after Germany began launching its V-1 Buzz Bombs against England, Materiel Command obtained parts of the weapon from the battlefields and within two weeks succeeded in copying the V-1's pulse jet engine. By September 8, less than sixty days after they had begun, Wright Field and Republic Aviation engineers had produced a copy of the German V-1 for testing.

Although the V-1 had caused a sensation when it was first launched by the Germans, the AAF and Royal Air Force (RAF) quickly learned to master the missile with their fighter aircraft and anti-aircraft guns. Gen. Carl A. Spaatz, Commanding General of the United States Strategic Air Forces in Europe, and Gen. Ira C. Eaker, Commanding General, Mediterranean Allied Air Forces, foresaw "no immediate requirement for the use of pilotless aircraft."<sup>10</sup> Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, also opposed developing an American version of the V-1, because he considered it uneconomical. Among those favoring development were General Arnold and Robert A. Lovett, the Assistant Secretary of War for Air. Lovett believed that the AAF should match the enemy, if only to counter the V-1's potential for damage.<sup>11</sup>

\* In 1946 the Air Proving Ground Command at Eglin Field, Florida, ran extensive tests on Razon, contemplating using the missile aboard all-weather bombers. Nothing materialized, however, until the Korean War, when the Far East Air Forces ordered and used the Tarzon, a Tallboy-Razon combination. [Mary R. Self, *History of the Development of Guided Missiles, 1946-1950* (Wright-Patterson AFB, Dec 1951), pp 32-34.]

**BY AUGUST 1945 THE AAF HAD TEST-LAUNCHED MORE THAN 200 OF THE MISSILES AND BY MID-SEPTEMBER, ... HAD ACCEPTED 1,391 JB-2s**



The JB-2 in flight.



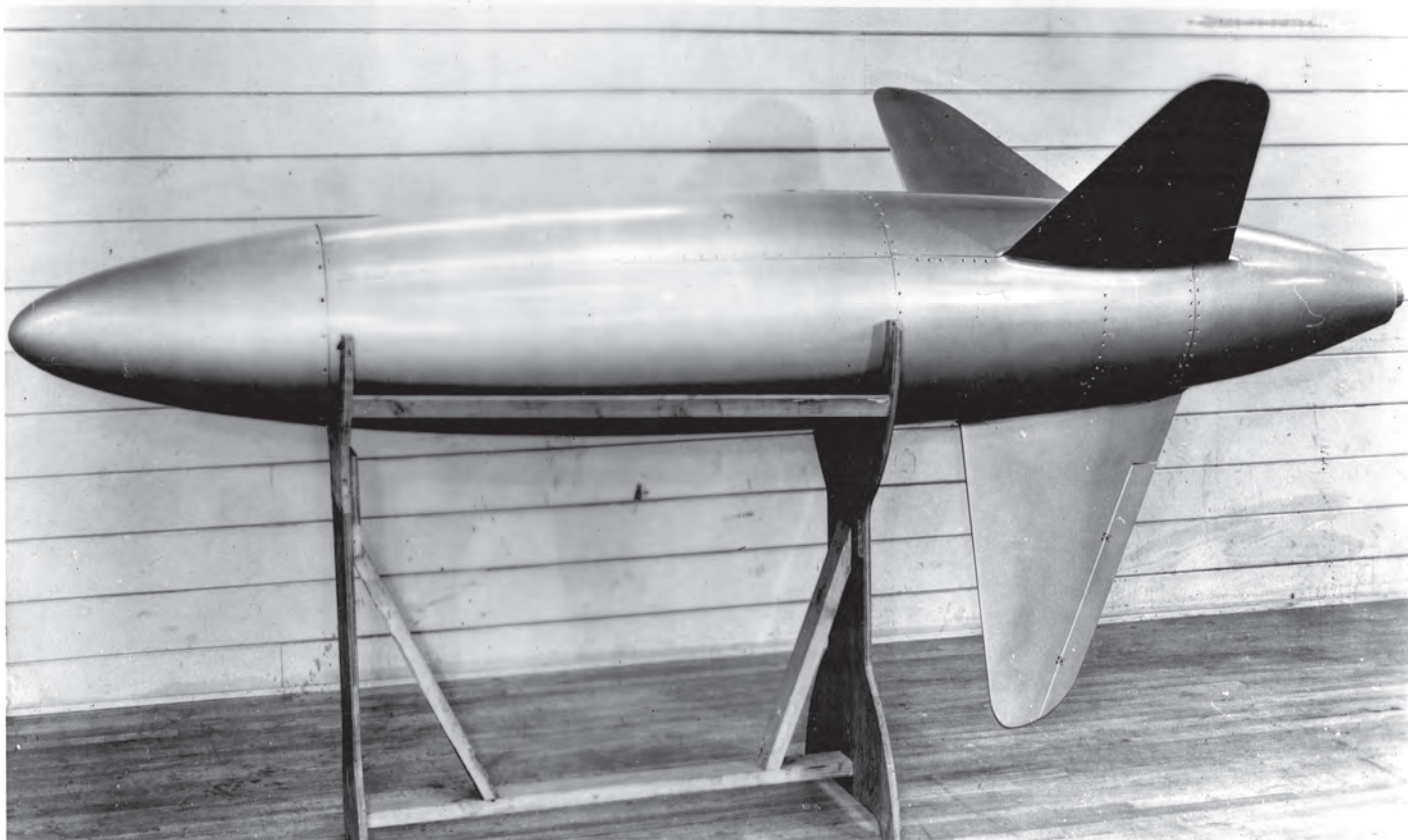
Called the JB-2 (for jet bomb), the American copy of the V-1 experienced launch difficulties and problems with inferior components and unreliable autopilots, but the AAF was satisfied enough to

order the missile into mass production. Lt. Gen. Barney M. Giles, AAF Chief of Air Staff, wanted to produce JB-2s in sufficient quantity to permit launching 500 missiles per day by February 1945. The War Department General Staff approved JB-2 production at a reduced level of 5,000 missiles. After applying a number of general improvements, the AAF contracted with the Ford Motor Company for the engine and the Willys Overland Company for the airframe.

Although the JB-2 was not ready in time for employment against its inventors,\* the AAF made good use of the missile in testing and training of personnel. By August 1945 the AAF had test-launched more than 200 of the missiles and by mid-September, when the contracts were terminated, had accepted 1,391 JB-2s. Development continued until 1946, when emphasis shifted to the Snark and Navaho missiles.<sup>12</sup>

Besides copying the V-1, the AAF also contracted with Northrop Aircraft to develop a new jet-propelled missile called the JB-1. This was a flying wing structure beset by shortcomings similar to those of the V-1, including low speed, small payload, limited range, and poor accuracy. First launched in December 1944, the JB-1 encountered an incompatibility problem between its airframe and engine.

\* Shortly after the end of the war in Europe, the War Department considered launching German V-1 and V-2 missiles against Japan. [Ltr, Gen Marshall to Gen Eisenhower, no subj, May 6, 1945. RG 341, AAG File (TS), NA.]



The JB-3.

This difficulty led to several modifications and a redesignation as the JB-10. The new version, however, proved little better than the original, and the service dropped the project altogether in March 1946.

In addition to the JB-10, only the JB-3 air-to-air missile remained under development at the end of the war. Research on the JB-3 was performed by Hughes Aircraft and the National Advisory Committee for Aeronautics.<sup>13</sup> ■

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# READERS' FORUM

## Speaking Truth to Power

CRAVEN AND CATE WAS WRITTEN TO JUSTIFY AIR FORCE INDEPENDENCE FROM THE ARMY AND TO PROVE THE EFFICACY OF STRATEGIC BOMBARDMENT

**Alan R. Gropman**

I am honored and humbled by this recognition and I thank the Air Force Historical Foundation for this high honor. I know my nomination came from Lt. Gen. Russell Davis, who is a Foundation officer and also was president of the Tuskegee Airmen Incorporated. The relationship between the Tuskegee Airmen, the Foundation, and the Office of Air Force History has been close and important for advancing the history of the Tuskegee Airmen. It began forty years ago, when Larry Paszek from the History Office published a significant article on the Tuskegee Airmen. Since then, the books from the Air Force History Office, articles in *Air Power History*, and lectures at historical symposia have furthered the history of the Tuskegee Airmen long before major commercial publishers were willing to broadcast this important record.

I know Bill Holley and have admired him since I first read his masterful *Ideas and Weapons* and have learned a great deal from him. I am not in his league, and consider Bill to be an all-star major leaguer. The most important professional point I imbibed from Bill is this: An institutional military historian must speak truth to power. If for one reason or another the historian fails to speak the truth, mistakes may be repeated, promising concepts not fitting the current doctrine or program objective memorandum may be overlooked, and gifted leaders not in a promoted weapon system will probably be overlooked.

Because I have been allotted a maximum of only ten minutes, I will cite just two examples in which the Office of Air Force History was not allowed to speak truth to power.

The first was when Wesley Frank Craven and James Lea Cate co-edited the official history of the war, *The Army Air Forces in World War II*. The second instance involved some senior Air Force leaders and official historians who sought to block publication of *The Gulf War Air Power Survey* (GWAPS). The GWAPS documents did not substantiate the views of some key people of Air Force contributions to the military victory in Desert Storm. I will leave it to others in the audience to

cite additional examples from the Air Force or other services. I know I can.

Let me begin by recognizing the dilemma facing the institutional military historian working in a hierarchical bureaucracy, like the Air Force, Navy, Army or Marine Corps. He or she probably owes big money on their home and possibly has kids needing orthodonture. Asking such a person—without power—potentially to risk their career is asking a lot. The typical action officer in the Pentagon has similar problems and the price can be high indeed.

Craven and Cate faced a similar challenge in editing the work of a team of historians hired to research and write the history of a massive and expensive global effort, while simultaneously satisfying the Air Force's leadership. This seemed especially true when the latter were wedded to the idea of strategic bombardment as the most efficacious warfare concept, if not *the* war winner.

Dick Kohn, the Air Force Historian, hinted at the problem in his Foreword to the 1983 reprint of Craven and Cate:

*Like all history, [Craven and Cate] reflects the era when it was conceived, researched, and written. The strategic bombing campaigns received the primary emphasis, not only because of a widely-shared belief in bombardment's contribution to victory, but also because of its importance in establishing the United States Air Force as a military service independent of the Army.*

In other words, Craven and Cate was written to justify Air Force independence from the Army and to prove the efficacy of strategic bombardment. Kohn continued:

*The huge investment of men and machines and the effectiveness of the combined Anglo-American bomber offensive against Germany had not been subjected to the critical scrutiny they have since received. Nor, given the personalities involved and the immediacy of the events, did the authors question some of the command arrangements.*

THE MEN IN POWER WERE LARGELY FROM THE BOMBING COMMUNITY



**AIR FORCE SECRETARY DONALD RICE COMMISSIONED AN INDEPENDENT SURVEY OF THE USE OF AIR POWER DURING THE WAR. THE RESULT WAS THE GULF WAR AIR POWER SURVEY, WHICH DISSECTED THE LESSONS OF THE WAR AND DEFINED AIR POWER'S LIMITS IN A SCHOLARLY AND ANALYTICAL WAY**

In other words, the men in power were largely from the bombing community. Moreover, Craven and Cate did not have access to everything they needed to write the whole story—in some cases because of classification.

The emphasis on aerial bombardment during World War II in the seven volumes created a foundation for an Air Force in which that mission received overwhelming emphasis to the detriment of other undertakings. From the late 1940s through most of the 1960s, Air Force rank and responsibility resided in the realm of strategic operations. To verify this assertion, one needs only to read the basic doctrine publications of the era just delineated.

The second example is Desert Storm. I rely here on my own knowledge of the point of view of senior Air Force leaders, civilian and uniformed regarding *The Gulf War Air Power Survey* (GWAPS). For another source, I lean on General Mick Trainor's comments in *The Generals' War: The Inside Story of the Conflict in the Gulf*. Trainor and his co-author, Mike Gordon, are highly critical of all four services and also of the political leadership in Washington. For example, they contend Desert Storm was a military victory, but war is politics.

The Office of Air Force History comes in for specific criticism. Trainor (I know the book was a

partnership, but these pages are overwhelmingly Trainor's) argues: "The Air Force . . . portrayed the war as a vindication of the long quest to achieve a victory through airpower, boasting . . . airpower had destroyed Iraq's weapons of mass destruction, severed its lines of communication and cut off the Iraqi troops."

He then criticizes senior officers—by name—accusing them of dissembling, while he praises the Air Force's civilian leadership: "On the whole . . . the Air Force was much more forthright than the Army."

Air Force Secretary Donald Rice commissioned an independent survey of the use of air power during the war. The result was the *Gulf War Air Power Survey*, which dissected the lessons of the war and defined air power's limits in a scholarly and analytical way. The study's analysis was not welcomed by everyone in the Air Force. In an April 1993 memo, Dick Hallion, the official Air Force historian at the time, "suggested . . . the report be withheld. . . [To his credit, the Air Force Secretary] 'ignored' the official historian's memo and 'published the lengthy critique.'" Trainor missed part of the story, because some powerful uniformed leaders in the Air Force wanted GWAPS suppressed and its official historian was their tool (not, incidentally, that he disagreed). GWAPS under the leadership of Eliot Cohen and ably assisted by Bob Kelley, Tom Keaney, Wayne Thompson, and Joe Guilmartin is a solid study that deserved to have been published.

What then might be done to ensure institutional historians can speak truth to power? The simple answer is to remove the powerful from the chain of approval and also from the influencing equation. Is there a model? Yes, the way war colleges and the National Defense University at Fort McNair get journal articles approved. It is not by sending them to the Pentagon, but by approving them internally. Several decades ago, censorship was an issue at the top level United States Corona meetings. The *iron majors* and *iron generals* in the Pentagon had become so involved in censorship it was driving the publisher of Air University Press mad. At last, the solution was found and implemented by removing the Pentagon from the censorship role. I assert we can and must do similarly with all the services history offices if we are to speak truth to power. ■

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# READERS' FORVM II

## Lavelle—From My Perspective

By Delbert R. “Chip” Terrill

**I REMAIN  
STEADFAST  
IN MY  
CONVICTION  
THAT BOTH  
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CHARGES  
WERE, IN  
TRADITIONAL  
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VERNACU-  
LAR, “ON  
TARGET,  
SIR!”**

For those who may not remember, I was the active duty, Air Force first lieutenant who filed court martial charges against Gen. John D. Lavelle on June 20, 1972. I was at that time a member of the Concerned Officer’s Movement. Despite current reports that General Lavelle is innocent of the charges filed, I remain steadfast in my conviction that both my actions in filing the charges were, in traditional Air Force vernacular, “On target, Sir!” My involvement with the Concerned Officers Movement and a discussion of civil military relations will be left for another day, but for historical clarification, the motivations behind my charges against General Lavelle follow.

Dr. Wayne Thompson, the author of the official Air Force history regarding this time frame, wrote that I filed the charges against General Lavelle on behalf of the Concerned Officers Movement. Nothing could be further from the truth. I never consulted any other member of the Concerned Officers Movement prior to filing the charges. Despite the fact that our desks were just a few feet from each other at the very same time Thompson was writing this history and despite the rather heavy public flogging I took for my actions, he never interviewed me about General Lavelle.

Within months of my preferring the charges, the Reverend William Sloane Coffin, perhaps aptly described me, when he stated to me, “Everyone knows you’re the fascist of the peace movement.” Only David Addlestone, a former attorney with the Air Force Judge Advocate General, knew and had been consulted prior to my filing the charges.

Recently, I watched with fascination Tom Brokaw’s HBO special regarding the Boomer Generation. For me, the most poignant moment was when David Harris (former Stanford student body president and active draft resistor) noted that Vietnam will forever cause an angst among the Boomers and there will never be tranquility among us over Vietnam unless there can be a dialogue. Here’s to you, David, and my effort at such dialogue.

As the fictional Sgt. Joe Friday of the LA Police Department always would say on *Dragnet*: “Give me the facts, sir – only the facts.”

Ironically, despite the public perception of my court martial charges, I actually admired General Lavelle for his loyalty to his subordinates over his frustration with the rules of engagement (ROE). No matter how one slices and dices the Op Reps/ROE’s, the record is clear that General Lavelle had chafed internally within the Air Force against the ROE which he perceived had required him to put his troops in harm’s way before reacting. At the time I filed, I framed my charges and perhaps part of the ensuing debate regarding General Lavelle’s actions on a “law and order” framework. However, anyone who saw and digested my appearance on Edwin Newman’s *Newsmakers* program would have understood that the motivations behind my actions were far more complex and subtle. During my brief time allotted on that program to explain my charges, I clearly indicated that I likely may have done the same as General Lavelle had I been in his position, except that I would have reported without prevarication my actions and been willing to take the heat.<sup>1</sup>

To me, General Lavelle’s actions in protecting his troops were the antithesis of what Gen. William Westmoreland had done during the NVA buildup prior to the Tet offensive in February 1968. General Westmoreland failed to warn his troops about the potential of a massive enemy offensive despite having intelligence about that buildup. General Westmoreland himself, before he died, acknowledged the potential significance of his failure to publicly disclose that intelligence information presented to him prior to Tet. Appearing on the NBC *Today* show in May 1993, General Westmoreland explained: “It was the surprise element, I think, that did the damage. And if I had to do it over again, I would have called a press conference and made known to the media the intelligence we had.”<sup>2</sup> However, while making an apology to the country for the resultant surprise, General Westmoreland never acknowledged the responsibility a commander owes to the troops under his command, which responsibility he failed to uphold.

Washington, D.C. is, as many long timers will tell you, a town with many unique and unexpected connections. Because of my active leadership in the





Gen. John D. Lavelle.

**IRONICALLY, DESPITE THE PUBLIC PERCEPTION OF MY COURT MARTIAL CHARGES, I ACTUALLY ADMIRED GENERAL LAVELLE FOR HIS LOYALTY TO HIS SUBORDINATES OVER HIS FRUSTRATION WITH THE RULES OF ENGAGEMENT**

Concerned Officers Movement, I got to know *New York Times* reporter Seymour Hersh, who had attended a couple of our meetings. Over time, Seymour and I had many conversations about my work on Project Corona Harvest and I tried to get him interested in writing about it since its contents had had such a dramatic impact on my life and had led to my conversion to opposing the foreign policy underpinning our Vietnam actions.

It was Seymour then who first contacted me in late March or early April 1972, because he had heard it through the Washington grapevine that General Lavelle had been removed as Commander of Seventh Air Force. When he asked why, Seymour told me he was getting what he thought was Air Force disinformation; i.e. that General Lavelle was being retired for personal and health reasons. Seymour asked if I would check around to see what I could find. All I got from a loggie connection was that General Lavelle, while in Europe, had pushed the aircraft under his command to the limit of their maintenance requirements resulting in some disgruntlement over there. That is what I reported back to Seymour but that was clearly not what was behind General Lavelle's removal.

When the truth about General Lavelle's removal was made public, I spoke with Seymour and right off the bat he told me that he always believed that Henry Kissinger was back channeling Seventh Air Force and that he, Seymour, thought

that General Lavelle was being made a scapegoat. So when more information was made public as to the reasons for General Lavelle's removal, I thought that it seemed that General Lavelle was being removed for being loyal to his troops, while General Westmoreland had gotten promoted to Army Chief of Staff for doing the opposite.

I told Seymour that I had never heard any rumblings about a Kissinger connection. That would have been the end of it for me. I figured if General Lavelle was not willing to stand up and fight city hall—then he deserved whatever he was getting.

But the above was only the early part of the backdrop that I knew when I filed the charges later in June 1972 against General Lavelle and why I thought he should have a chance to tell the truth in a court martial setting.<sup>3</sup>

As I mentioned, Washington, D.C. is a small town in many ways that results in serendipitous, chance occurrences let alone that everyone also seems to know everyone else. Two things had happened that caused me to reexamine General Lavelle's situation and eventually file the charges. During late April or early May, I was directed to report to Malcolm Grow Hospital at Andrews AFB, Maryland, for a physical exam. Because of my diagnosis of asymptomatic sarcoidosis at the Academy, I was assigned to see a particular physician. We chatted informally—while he was asking me how I was doing – at some point I told him of my involvement with the Concerned Officers Movement because several physicians at Malcolm Grow had periodically attended our meetings. My assigned physician, by a twist of fate, had also examined General Lavelle for his retirement physical on April 2, 1972. My assigned physician told me how he had examined General Lavelle and had found no basis for a disability retirement. Then he told me that he, the physician, had been informed through the medical system that General Lavelle was going to be retired on a disability without any medical justification, contrary to his opinion as the evaluating physician. Finally, he caustically noted that General Lavelle had been continually certified by flight surgeons as being fit to fly and was now all of a sudden disabled. He also described how General Lavelle had been receiving flight pay until the day he retired. My brain kept flashing that something was clearly wrong with this picture, and it appeared to me that General Lavelle may have been paid off to go quietly into the night.<sup>4</sup>

Not long after my physical, Air Force 1st Lt. Mike Burkett, an Academy classmate of mine from Keosauqua, Iowa, and who periodically attended meetings of the Concerned Officers Movement, was invited by Darrell Netherton, a Capitol Hill staffer to attend an Iowa State Society gathering. Mike invited me to go along which I did. During the State Society gathering, people were standing around talking, and it eventually came out that I was active with and a leader of the Concerned Officers Movement. Dr. Charles Stevenson who worked as a foreign policy advisor for Senator Harold Hughes of

A B-52 unloads its cargo of iron bombs.



I HAD HOPED, PERHAPS NAIVELY, THAT GENERAL LAVELLE WOULD SEIZE THE OPPORTUNITY TO DEFEND HIMSELF THAT A COURT MARTIAL PRESENTED AND THAT FROM THE PRESS COVERAGE THAT HIS COURT MARTIAL WOULD ENGENDER

Iowa was present and overheard this discussion. Later that evening Stevenson introduced himself. After most of the attendees had left, Stevenson took me aside and told me that Senator Hughes had a constituent, whom Stevenson did not name (but who I would later learn was Sgt. Lonnie Franks), that they and the constituent himself were concerned about Franks' safety in Thailand for having blown the whistle on General Lavelle. So these were the facts I knew at the time I preferred the court martial charges against General Lavelle.<sup>5</sup>

I had hoped, perhaps naively, that General

Lavelle would seize the opportunity to defend himself that a court martial presented and that from the press coverage that his court martial would engender, I also thought perhaps such would expose President Johnson and General Westmoreland for what I thought they had perpetrated at the time of the Tet offensive.

I also perceived that by filing the court martial charges I could expose the disability retirement for General Lavelle that had all the trappings of a pay-off (which may have led to an even earlier end to a corrupt Nixon administration that had ensnared

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*While in the Air Force Reserve, he previously served at the Department of Legal Medicine, Armed Forces Institute of Pathology, and the Office of the Surgeon General of the Air Force. He is a graduate of the Air War College (outstanding graduate), the Armed Forces Staff College, and the Air Force Squadron Officer School. In February 1994 and July 1997, Colonel Terrill attended the Sixth and Seventh Biennial Conferences on the Law Relating to National Security Activities in Outer Space. His prior publications include "Air Force Role in Developing International Outer Space Law" Air University Press, (1999); "Complaint Procedures Initiated by and Against Federal Administrative Law Judges Need Reform Now," Judge's Journal (Fall 1994); Chapter Two "The Patient, the Hospital and the Law," Lawyers Medical Cyclopedia (Allan Smith Publishing Company, (1981); and "The New Copyright Law: How It Affects Physicians," The Journal of Legal Medicine (1977). He is a recipient of the Legion of Merit, Air Force Meritorious Service Medal and the Air Force Commendation medal among other decorations.*

“HELL, NO ONE IS GOING TO LISTEN TO THIS, NOR UNDERSTAND YOU. YOU HAVE PUT WAY TOO MUCH THOUGHT INTO THIS, AND YOUR MOTIVATIONS AND FEELINGS ARE WAY TOO COMPLEX, IF NOT CRAZY.”



General Lavelle via its own duplicity. The Watergate break-in followed the very next day after my court martial charges and I could relieve and deflect the pressure being felt by Sergeant Franks.

Much of this explanation was long ago provided during an interview with an ABC radio person whose name I do not remember. After he was done interviewing me, he basically responded: “Hell, no

one is going to listen to this, nor understand you. You have put way too much thought into this, and your motivations and feelings are way too complex, if not crazy.” I wish now that interview had gone public and/or that I had a transcript of it. I am sure General Lavelle would have been quite amused to hear me say on the radio that I wanted to give him a chance to clear his name via a court. ■

## NOTES

1. While I was known for my boxing, cheerleading, running the cadet ski club, and for being a bit of a “hell raiser” as a cadet at the USAF Academy, those who knew me will attest I was always a straight arrow, perhaps often unbending in my convictions and a particular strong supporter of the honor code. I always articulated that one leads by example, making the point that no higher up should be treated any differently from anyone else in the chain of command.

2. By summer 1969, and a relatively short time after the Tet offensive, as result of my assignment by the USAF Academy to the Honors Summer History Research Program involving Project Corona Harvest/CHECO, I had learned of Gen. Westmoreland’s failure to warn his troops.

3. During my time at the USAF Academy, Army Air Corps Gen. Billy Mitchell was always perceived by the cadets and faculty to be among our most esteemed leaders despite his court martial. In fact, the dining hall at the Academy is named after him. I had hoped falsely as it turned out that General Lavelle might turn out to be a Billy Mitchell.

4. As a result, I became the original source about the potential of an underserved disability retirement involving General Lavelle (and eventually a scandal that broadened to more general officers than just General Lavelle). I also helped raise questions about the management of the flight pay system by working with the staffs of Senators William Proxmire and Harry S. Byrd, whose review led to amendments to change the military’s disability retire-

ment system and the institution of the infamous gate system for a determination of flight pay.

5. Having worked on Project Corona Harvest in summer 1969 and having been assigned to review documentation from the earliest relationships of the U.S. with Vietnam, including our early involvement pre- and during and post World War II, much of which information was subsequently made public by the Pentagon Papers, and then much later by the declassified writings of Bernard Fall and the declassified World War II OSS reports and writings of Archimedis Patti, and others led me to conclude that Vietnam was a waste of American lives and financial capital. And, while I refrained from disclosing the classified information that was the basis of my conviction, I felt an obligation to the American people to tell them that we were pursuing a failing foreign policy. I had concluded that we never belonged there to begin with as Ho Chi Minh’s letters to Dean Acheson and President Harry S. Truman had undercut any reliance on the so-called domino theory, that we were not fighting to win, and that we had no viable exit strategy not even President Nixon’s Vietnamization policy as time ensued became clear was not viable. As I tried to explain to Gen. John D. Ryan in September 1971, long before General Lavelle became an issue, I was prepared to go and serve and be the best damn Air Force officer in Vietnam if sent, as I always understood that military officers must subrogate their political views to the national will as set by the National Command Authorities.

**Footprints in the Dust: The Epic Voyages of Apollo, 1969–1975.** By Colin Burgess, ed. Lincoln and London: University of Nebraska Press, 2010. Photographs. Appendix. Bibliography. Index. Pp. xxxiv, 486. \$34.95 ISBN: 0-8032-2665-4

Readers might anticipate that a book such as this, to which eleven different authors contributed, would lack compositional uniformity. Surprisingly, however, this sixth volume in the *Outward Odyssey: A People's History of Spaceflight* series contains a prologue, twelve chapters, and an epilogue of consistently high quality. Furthermore, as with its predecessors in the series, this tome captures and holds one's attention from beginning to end. From Rick Houston's description of Neil Armstrong's first step on the Moon in July 1969, to Geoffrey Bowman's excitement at seeing firsthand the last Apollo launch in July 1975, volume and series editor Colin Burgess has polished his ten collaborators' prose in sterling fashion.

Perhaps the most striking aspect of several chapters is a sense of the reader's being aboard the Command Module or the Lunar Module as different astronaut teams completed their missions. One vicariously shares in the gripping stressfulness of split-second decision making, in the unsurpassed excitement of walking or driving on the Moon, in the camaraderie of the Apollo-Soyuz Test Program, and more. Stephen Cass's enlightening comparison of the movie *Apollo 13* with reality, plus Geoffrey Bowman's disturbing explanation of astronaut Jim Irwin's mild heart attack and Mission Control's lack of situational awareness during the rendezvous of *Falcon* and *Endeavor* on the *Apollo 15* mission, gives readers a keen sense of the dangers associated with spaceflight beyond Earth orbit.

Even those who can remember watching television's coverage of Apollo will enjoy the many anecdotal tidbits sprinkled throughout *Footprints in the Dust*. Astronaut Ed Mitchell's performance of psychic experiments while *Apollo 14* coasted between Earth and Moon smacks of legerdemain. The *Apollo 15* crew's receipt of an official reprimand after spiriting away to the lunar surface hundreds of lightweight postal covers conjures an image of the grade-school principal punishing puerile pranksters. Then, there was Charlie Duke's risky attempt to set a lunar high-jump record during the *Apollo 16* mission and the mystery of Jack Schmitt's lost scissors on *Apollo 17*.

While lacking scholarly annotations that would lead readers easily from the narrative to specific sources, *Footprints in the Dust* contains a useful compilation of

references for anyone curious enough to want more information. The list ranges from books, periodicals, and online articles, to several dozen interviews and personal communications. Other types of material apparently used by the authors include mission transcripts, press kits, NASA reports, live sound recordings, film, video, and a personal diary and scrapbook. Generally speaking, one can determine which references likely correspond with which chapter.

Perhaps the most surprising feature of this book, given its subtitle—*The Epic Voyages of Apollo, 1969-1975*—is a trio of interspersed chapters about Soviet human spaceflight during the same period. This juxtaposition of U.S. and Soviet activities starkly contrasts hopes and disappointments, successes and failures, triumph and tragedy. Ultimately, coverage of Zond, Soyuz, and Salyut lays a substantial foundation for appreciating the last Apollo flight—the Apollo-Soyuz Test Program.

Robert Pearlman's epilogue adds a particularly poignant, final touch. He catalogues the “mementos, as varied as the men themselves,” that the twelve astronauts who walked there deposited on the Moon as personal “touchstones.” From a family photo, a shamrock, and a golf ball, to a falcon feather, a lapel pin, and a rock hammer, each object captured the character of the particular astronaut who left it on that faraway orb. In addition, Pearlman summarizes what walking on the Moon meant personally to each of the twelve. What better way to whet a reader's appetite for the seventh volume in the series.

*Dr. Rick W. Sturdevant, Deputy Director of History, HQ Air Force Space Command*



**The Candy Bombers: The Untold Story of the Berlin Airlift and America's Finest Hour.** By Andrei Cherny. New York: Penguin, 2009. Photographs. Notes. Bibliography. Index. Pp. xiv, 624. \$18.00 ISBN 978-0-425-22771-8

There are few moments in history where so much has hung in the balance. Berlin in 1948 was one of those. Cherny's well-researched and easy-to-read narrative tells us, from the personal perspectives of those who were there, how the Berlin airlift narrowly avoided plunging Europe back into war. The standoff over Berlin became the catalyst of the decades long Cold War that launched America into the role of a Superpower. The point of this book is not “to be a comprehensive history

of Berlin...it is a story of America at her best, but it is by no means a simple straight line story.”

Indeed Cherny weaves this tale beginning with the final days of World War II, as the Soviet Union's Red Army bore the brunt of the final assault on Berlin, through those first tenuous days of occupation, and finally into the bleakest depths of the blockade itself. In the process he shows that history is not simply made up of mindless events, but rather of individuals who made grievous miscalculations, dodged a potential nuclear war by sheer luck, and acted with extreme compassion. The compassion is where this account derives its title, as it follows the events of USAF pilot Gail “Hal” Halvorsen, who gave to the Berlin airlift one of its most memorable images: chocolate bars parachuting to eagerly waiting German children on the verge of starvation.

Halvorsen's deviation from General William Turner's intricately choreographed airlift schedule, constituted an act of insubordination that could have potentially ended his career. Instead, it began a snowball effect that would eventually galvanize not only the people of Berlin, but also a reluctant America, into resisting the westward advance of Communism. This drives home Cherny's point: that simple decisions paved the way for breaking the blockade while avoiding World War III, implementing the Marshall Plan, and launching modern Europe.

Not only does this account trumpet the victory of democracy, but it also highlights the seemingly mundane logistical operations that went into sustaining this vital air bridge. Accomplishing this was no simple task and required clockwork precision, innovative ideas, and the heavy airlift capabilities of the Douglas C-54 Skymaster. Airlift pilots like Halvorsen, who had seen little combat during the war, suddenly found themselves flying through inhospitable winter weather deep into unfriendly skies while often confronted by Soviet fighters and anti-aircraft fire. Remarkably, the airlift saw few casualties, largely due to the policies established by General Tunner. Despite the long odds, this air bridge was able to feed the city through one of the bleakest winters on record.

Despite its healthy length, *Candy Bombers* reads quickly, mainly due to an engaging writing style coupled with the personal nature of every facet of the tale, from the President to the flight line. Its one drawback is that it contains too few maps, graphics, and photographs. There is one section of photographs, but most are familiar press photos. Maps of Berlin to include the blockade air routes used or

graphs that would give a visual depiction of just how impressive the Airlift's accomplishments were would have surely hammered home this text. Despite this, Cherny effortlessly integrated several storylines into perhaps one of the best accounts of the Berlin Airlift—a true turning point and a critical moment in history.

*Maj. Matthew Dietz, USAF, F-15E pilot, NATO Combined Air Operations Center, Poggio Renatico Italy.*



**Remembering the Giants: Apollo Rocket Propulsion Development.** By Steven C. Fisher and Shamin A. Rahman, Eds. Washington, D.C.: NASA, 2009. Notes. Photographs. Appendices. Glossary. Index. Pp. 208 (paperback) NASA SP-2009-4545

This lavish commemorative volume was produced by NASA's John C. Stennis Space Center to mark the fortieth anniversary of the first rocket engine test conducted at the then Mississippi Test Facility on April 23, 1966. It consists of lectures given during a seminar covering the eight separate Apollo rocket propulsion systems. Each chapter contains the edited transcript of one of the lectures and covers the historical background behind each engine, significant technical challenges faced, and lessons learned during development.

Chapter 1 focuses on development of the F-1 engine. A cluster of five F-1s, each rated at 1,500,000 pounds of thrust, was used for the first stage of the Saturn rocket. Although based on technology then being used on ballistic missiles, the F-1 was ten times larger than any U.S. rocket engine then in production. The cluster burned 1.5 million pounds of propellant in 2-1/2 minutes and provided enough thrust to throw the 6-million-pound Apollo launch stack 50 miles down range at a height of 40 miles and a speed of Mach 7.

The J-2, a liquid oxygen/hydrogen engine with a thrust of 230,000 pounds, is discussed in chapter 2. Four were on the Saturn's S-II second stage, with one on the S-IVB third stage. The technology needed was not well known at the start of the program; because, unlike other engines, the J-2 had to be restartable. The analytical tools the engineers created to solve J-2 design problems were later used to develop the main engines on the Space Shuttle.

The next chapter covers the small, 100-pound-thrust R4D engines, 12 of which provided attitude control for the Apollo Command Module and 16 for the

service module. Although Marquardt was awarded the contract to develop this small engine, Rocketdyne had to be called in to provide the thrust chamber after Marquardt ran into trouble. The lecture discussed the problems that had to be overcome in order to produce a reliable engine.

The 72-pound-thrust SE7-1 and 92-pound-thrust SE-8 are covered next. Both were derived from Gemini orbital maneuvering engines and were of similar construction. Two of the tiny SE7-1s were located near the bottom of the S-IVB. Their job was to give a little bit of gravity to push the propellants to the bottom of the fuel tanks in order to start or restart the single J-2 engine in zero-G. The SE7-1 had no major development issues, but this was not the case for the SE-8 engine that provided attitude control for the Apollo Command Module during re-entry. Because the command module entered the atmosphere at 24,000 mph, its heat load was four times higher than that on Gemini, which was only going 17,000 miles per hour. This required material changes to ensure operation under the higher heat load. Two redundant systems of six engines each maintained proper orientation of the heat shield during re-entry. The tiny SE-7 and SE-8 engines cost about \$35,000 each in 1963—about the price of a Rolls-Royce at that time.

Although planned redundancy was a hallmark of the Apollo Program, two engines had to work perfectly if the astronauts were to return safely to earth: the lunar ascent engine and the Service Propulsion System (SPS) engine on the Service Module. The SPS engine is discussed in chapter 5. The size of this 20,000-pound-thrust engine was set before Apollo adopted the LEM concept. It was originally intended to lift the command module off the moon and return it to Earth. The decision to use a single thrust chamber (in lieu of several engines) was based on weight and efficiency and used redundant valving to ensure engine start and shutdown.

Lunar descent engine reliability was less critical, because the lunar ascent engine served as a backup in case of mission abort. Nevertheless, it was a critical piece of equipment that had to function correctly if the astronauts were to land successfully on the Moon. Adding complexity to the design was the requirement that it be throttleable. TRW overcame this problem by using both a flow control valve and a variable inlet. This project is described in chapter 6.

The lunar ascent engine is the last to be discussed. Like the SPS engine the ascent engine had to work. If it didn't,

President Nixon had a letter to be read if the astronauts were stuck on the Moon. "It was a scary letter, really. The ascent engine was an engine that had to work." Testing was the key to high reliability.

The material is highly technical in nature. Those not interested in the minutia of rocket engineering are advised to look elsewhere. I would recommend this work only for serious scholars interested in investigating the detailed nature of rocket development during the Apollo Program. Such individuals will find the viewgraphs in the appendices to be an additional source of useful technical data.

*Thomas Wildenberg, Burtonsville, Md. (The reviewer worked on the J-2 engine in the late 1960s.)*



**The B-45 Tornado: An Operational History of the First American Jet Bomber.** By John C. Fredriksen. Jefferson N.C.: McFarland & Co., 2009. Photographs. Notes. Appendix. Bibliography. Index. Pp. 264. \$45.00 Paperback ISBN: 978-0-7864-4278-2

The author has some experience writing about military history topics in as much as he has published some twenty books in the genre. This book is an easy read even though there are a few phrases that are repeated regularly. He tells his story nicely.

The book is titled as an operational history of the United States' first operational jet bomber. And such it is. It tells the story of a jet-powered airplane using the old straight-winged technology of World War II that is entering the new era of swept-winged, jet-powered aircraft. It is the story of an Air Force in transition from the internal combustion engine to the gas turbine (jet) engine. There were things in the transition that were not considered—if only because no one realized they should be—that cropped up in the test flying of this airplane. The vibration-free flight caused flight instruments to freeze in place; there was no vibration from the engine to keep them unfrozen. The solution was a vibrator in the back of the instrument panel. Takeoff runs that were longer than usual, or expected, at high elevations or high temperatures were frequent occurrences. Landing the new jet-powered aircraft proved to be very different than landing the piston-powered aircraft; jets floated more readily. The jet engine was proving to be a very different method of propulsion. This is one story of the Air Force and its flight crews in tran-

sition between technologies.

It is also the story of another technology in transition—atomic. The B-45 introduced the tactical Air Force to the carriage and use of tactical atomic weapons. The Air Force learned how to carry and drop such weapons in an era of higher-speed aircraft at both the tactical and strategic levels. Targets moved in the bombsight faster in the jet than in the piston-powered aircraft. But it was as an interim aircraft between the strategic bomber of World War II and the B-47 that it proved useful. The Air Force needed it because the swept-wing, jet-powered strategic bomber was behind in its development; and this airplane kept the Air Force in the game until the B-47 became operational.

In the B-45 the Air Force found its first spy plane. Both the U.S. and England found a use for the Tornado in the strategic reconnaissance role. They sent the airplane over Soviet territory to gather information about what was on the other side of the border—information that was otherwise unavailable. It was the Strategic Air Command's first such airplane and General LeMay was glad to have it, because it gave him target information for his B-36s and, eventually, his B-47s. The Tornado was also used over North Korea and in parts of China during the Korean War to gather intelligence data needed by planners and negotiators. It proved to be very effective at this clandestine task.

There are plenty of photographs throughout the book. Several introduce new livery for the aircraft in black and white. Color photos would have been worth the extra expense to actually display the new paint schemes. In fact, more color photos would have been nice throughout.

The story told here is an interesting one because much of it is told by the people involved with the Tornado. Fredriksen interviewed both flight crews and maintenance people to help him tell the story. Many of the flight crews look back fondly on their time in the Tornado; many of them did not want to give it up for the B-47.

*Ray Hain, Docent, NASM's Udvar-Hazy Center*



**Into That Silent Sea: Trailblazers of the Space Era, 1961-1965.** By Francis French and Colin Burgess. Lincoln: University of Nebraska Press, 2007. Photographs. Bibliography. Glossary. Index. Pp. xxvii, 407. \$22.95 ISBN: 978-0-8032-2639-5

Spaceflight is probably mankind's single greatest technological achievement. It continues to fascinate us even as we have come to accept humans traveling beyond our atmosphere as a relatively routine occurrence. Occasional tragedies remind us that it isn't routine at all. But, beyond our wonder at the thought of people actually traveling to space, these activities just don't intrude on our daily lives. That wasn't always the case. The entire world was enthralled in the late 1950s and early 1960s with, first, the vision, and then the reality of humans venturing into an uncertain realm. These first spacefarers were pioneers in every sense of the word, and it is with this in mind that French and Burgess introduce us to these brave men and women.

This work is one of a series chronicling the development of spaceflight and space exploration. It is not a history of the programs or bureaucracies but, rather, the stories of the men and women who challenged themselves and the unknown by volunteering to become what some American test pilots derisively referred to as "spam in a can." The book is arranged chronologically but focuses on participants rather than specific events. The people represented are not all astronauts or cosmonauts. The first chapter introduces the reader to Dee Harris, a flight nurse with the U.S. astronaut program from 1959 to her retirement in 1981. Her story is juxtaposed with that of the first American in space, Commander Alan Shepard. The authors use this technique throughout the work to introduce some of the lesser-known figures in both the Russian and American space programs. It is an interesting approach and works well in providing a broader scope and deeper understanding of the programs and their participants.

The book is based to a great extent on interviews and first-person accounts providing the subject's goals and aspirations, strengths and weaknesses, and successes and failures. This approach provides a very human face to those who have been so lionized and mythologized that they might not even recognize themselves. The authors' perspective is objective but sympathetic throughout. They often point out discrepancies between official government and agency stories and the sometimes very different "real" stories told by participants. The result is a very readable and entertaining look at a truly amazing period of history.

The authors have solid credentials (French is director of education for the San Diego Air and Space Museum), and both have authored other works on space flight. The narrative is seamless: it is not appar-

ent if they co-wrote the entire work or each took specific chapters. They do not cite sources in the body; unless the source is explicitly mentioned (i.e., an interview or prior work), the reader is left to determine it for himself. The language is sometimes very poetic but does not cross the line into ostentation. The discussion of the Mercury 13 women seemed long. Dr. Lovelace, the man tasked with conducting many of the early medical adaptation tests for the astronauts, selected these women as part of his own interest in furthering knowledge about human adaptability to space. Unlike Soviet female cosmonauts, these women were never considered for the space program. While their story is interesting and did provide counterpoint to the Soviet experience, it seemed longer than needed.

All things considered, this is an excellent work and well worth the time for those with any interest in early space flight. It intentionally covers only Mercury, Vostok, and Voskhod; but that keeps both length and focus manageable.

*Lt. Col. Golda Eldridge, USAF (Ret.)*



**Hermann Göring—Fighter Ace.** By Peter Kilduff. London: Grub Street, 2010. Maps. Tables. Illustrations. Photographs. Notes. Appendices. Glossary. Bibliography. Index. Pp. 192. \$39.95 ISBN: 978-1-906502-66-9

Hermann Göring is best known as the bombastic, drug-addicted peacock (he loved showy uniforms) who led Hitler's Luftwaffe to defeat in World War II. What many don't know is his role as a highly decorated and successful World War I fighter pilot and combat leader. This phase of Göring's life hasn't received much attention—a situation Kilduff sought to remedy. He did so by trying to determine what led to Göring's early success and eventual failure. He looks at three key questions in the context of Göring's life up to the end of the First World War: (1) what events in his early life formed his determination to become a military officer, (2) what drove him to achieve the success he did during the first war, and (3) what motivated him and how did that affect him to behave later in ways that were so seemingly antithetical to the mores of the German officer corps?

This book is an interesting counterpoint to the letters of Max Immelman, an early German fighter pilot who pioneered many of the air fighting techniques pilots like Göring would later use to great suc-

cess. He and Göring were alike in some ways. Both found their way into the officer corps and then aviation via similar paths, and both achieved success as fighter pilots and leaders. But there the similarity ends. Immelman's letters reveal a committed officer and aviator whose focus was always on finding better ways to defeat the enemy. The many honors he received were a source of pride and wonder to him, but he never became absorbed in their pursuit. Kilduff demonstrates convincingly that Göring's focus throughout was on his own success, often at the expense of others. He was a man who was a bully from a very young age and an ardent anti-Semite. Göring's willingness to manipulate the facts and situations to his advantage are shown through his own words and those of others who knew and served with him.

This biography is arranged chronologically, detailing what Kilduff considers key moments in Göring's early life and career. He also uses interviews Göring gave during his Nuremberg confinement that provide own views on many of the incidents and issues discussed while maintaining the focus on information pertinent to the subject. The book is well written and the discussions clearly thought out, although Kilduff doesn't succeed in answering his three questions completely. There is enough information to demonstrate Göring's predisposition to a military career, but the why is not adequately explored. Kilduff does a good job of answering the second question showing Göring's strong desire for recognition and the methods he used to get it.

But the answer to the last question is not as straightforward as it might first appear. The German officer corps entering World War II had a very strongly defined, but very narrow, sense of honor. It focused on personal conduct while ignoring collective responsibility. Göring certainly violated the group's mores on personal conduct, and Kilduff shows his personality was inclined to do that in any event. What he doesn't address is the fact that it was this same officer corps that willingly abetted Hitler in his bid to dominate Europe. Göring's politicking and maneuvers to gain power certainly violated a sense of personal honor; but, in the end, his guilt seems more a matter of degree. Whether they participated in the more inhuman crimes of the Third Reich or not, the entire officer corps helped destroy Europe. Some did it within the narrow definition of their military responsibilities, others did not. But, in the end, Göring was chief among criminals, not an exception.

Kilduff is very knowledgeable about his subject. His discussion of the process for claiming aerial victories is particularly

enlightening. The high-quality book is beautifully bound and printed. Göring himself took many of the photographs. Interestingly, Kilduff provides in the endnotes a synopsis of the career of every Allied airman Göring claims to have shot down. Even with its limitations, the book is a useful work and an enjoyable read.

*Lt. Col. Golda Eldridge, USAF (Ret.)*



**Lockheed Blackbird Family: A-12, YF-12, D-21/M-21 & SR-71 Photo Scrapbook.** By Tony Landis. North Branch, Minn.: Specialty Press, 2010. Maps. Diagrams. Photographs. Pp. 128. Paperback. \$19.95. ISBN: 978-1-58007-151-2

This book is exactly what it claims to be: a scrapbook lovingly put together by someone who knows and admires the Blackbird. The attention to detail and the care put into it make the book a must-have for every true Blackbird aficionado. Landis has put together an impressive collection of photos of one of the most distinctive aircraft of all time. He is obviously very familiar with his subject and has been able to collect many never-before-published images including many from the Central Intelligence Agency (CIA) archives.

The book is arranged by aircraft type starting with the single-seat A-12 aircraft originally designed for the CIA as a replacement for the more vulnerable Lockheed U-2. There are chapters on the short-lived drone-carrying D-21/M-21 combination, the proposed YF-12 interceptor version, and the final and longest chapter on the SR-71 itself. The chapters are arranged chronologically starting with the design of each variant including engineering drawings and photos of mockups used for testing. Landis then moves through the life of each aircraft type by tail number illustrated by photographs.

There is very little text beyond the captions; but, given the book's focus, this is not in any way a problem. Someone interested in a more in-depth history of the aircraft development will need to look at the many other books on the Blackbird, especially those of Richard Graham, Donn Byrnes, and Paul Crickmore. There is a short introduction at the beginning of each chapter but no anecdotes by crewmember or other amplifying material. The bulk of the writing is confined to the short, but accurate, captions. About my only complaint was on pages where a caption referred to multiple pictures that weren't referred to by the conventional method of

their position on the page. These captions were still easy enough to follow, so this is a very minor criticism of an otherwise excellent work.

The photos are not only informative but also, in many cases, real works of art in their own right. One can only wish the book had larger dimensions so the pictures might be bigger. My favorite is one showing the SR-71 flying formation with an all black F-4J from the Navy test squadron VX-4. This excellent photo brings together two of my favorite airplanes in some of their best paint schemes and is just one example of the many outstanding photos in this enjoyable book.

This is definitely a niche publication about a very unique part of aviation history. But for those who have a love for exotic aircraft or the Blackbird in particular, it is well worth the investment.

*Lt. Col. Golda Eldridge, USAF (Ret.)*



**Flying Fury: Five Years in the Royal Flying Corps.** By James T.B. McCudden. Haverstown PA and Newbury UK: Casemate, 2009 [originally published 1918]. Photographs. Notes. Pp. 304. \$29.95 ISBN: 978-1-935149-1

Royal Flying Corps Major James McCudden, Victoria Cross, well captured his varied experiences in this book, his World War I autobiography. *Flying Fury* is part of Casemate Publishers' series of reprints of the autobiographies of significant people from the first fifty years of flight. The book opens with McCudden's entry into the military when he enlisted in the British Royal Engineers after three years as a bugler with the Engineers. With encouragement from his brother, McCudden managed to transfer into the Royal Flying Corps as an aircraft mechanic. Though his time in this specialty was short lived, he provided a detailed look into the world of maintenance during the Great War. McCudden next became an aerial gunner flying in Royal Aircraft Factory B.E.2c aircraft.

Finally, McCudden was selected for pilot training. He weaves an amazing flight-by-flight story of the air war over the trenches. McCudden traced his development from a wingman to a flight leader as his skills as a pilot slowly improved. His stories of engaging German planes and missing soon change to stories of shooting down enemy aircraft. Along the way, McCudden had some fascinating experiences: he flew for a time with fellow British ace, Arthur Rhys-David (25 kills);

witnessed the demise of German ace Werner Voss; and saw the Red Baron score one of his 80 confirmed kills. McCudden himself scored 50 kills and was fourth on the list of RFC aces.

In the five years McCudden flew, airplanes rapidly advanced. He described what it was like to fly each one of the models he flew, including such famous types as the Bleriot, Farman, Sopwith Pup, and Royal Aircraft Factory S.E.5. In fact, a recurring theme throughout the book is the frailty of the airplanes and how short the life expectancy of a World War I pilot was. There are numerous stories of pilots getting shot down, failing to return from a mission, or meeting misfortune when their primitive engines stopped in mid-flight. Unfortunately, McCudden fell into the latter category, dying in July 1918 when he crashed after engine failure shortly after takeoff.

In keeping with a request McCudden made prior to his death, his friend C.G. Grey, editor of "The Aeroplane," saw to it that these memoirs were published. Despite McCudden's request that he edit the book, Grey corrected only spelling and grammar. Hence, what we have are McCudden's raw and unpolished memories written a few months before his fatal crash. As a result, *Flying Fury* is an absolute unaltered gem. An additional strength of the book is that it covers nearly the entire war, including the very beginning of the Royal Air Force's rich history. While there are chapter notes at the end of the text, this edition lacks the log of McCudden's kills that is available in other editions. Even without such a log, the detailed descriptions make the book a great read, since the pilot's recollections appear to be fresh and without lapses. This is not a book for readers looking for a larger scale analysis of World War I. But it will particularly appeal to readers who want a "there I was" experience.

Dan Simonsen, Lt Col, USAF (Ret)



**Aviation in Canada: The Formative Years.** By Larry Milberry. Toronto: CANAV Books, 2009. Maps. Illustrations. Glossary. Bibliography. Index. Pp. 224. \$50 CAN ISBN: 978-0-921022-21-3 *and* **Aviation in Canada: Evolution of an Air Force.** By Larry Milberry. Toronto: CANAV Books, 2010. Illustrations. Glossary. Bibliography. Index. Pp. 336. \$53 CAN ISBN: 978-0-921022-23-7

Larry Milberry, the dean of Canadian popular aviation historians with twenty-

one tomes so far, covers the subjects he chooses with detailed texts and maps, multiple well-chosen illustrations with readable and detailed captions, specific indexes, and a select bibliography. The results are books that are visually pleasing as well as enlightening.

These two books are the second and third volumes in the new series on aviation in Canada. In the first of these, Milberry covers the development of Canadian civil aviation from 1919 to the 1930s. A great many of the aircraft of the period were water-based with open-cockpit pilots who were experts at bush operations. One result of the combination was a wonderful telescoping of time; for instance, a 200-mile surface journey could be undertaken in only 2-5 hours by air. In what was still a largely roadless Dominion, the attraction of travel by air was great, even though aviation companies for the first decade often led a hand-to-mouth existence.

The second of the two volumes carries the story of Canadian aviation to 1945. The sources here and the presentation are skewed somewhat by extensive use of notes, photos, and sketches from wartime veterans. Immediately following the end of the Great War, Canada began to form an air arm. However, for the first decade or so, it was really the aerial fleet of the civil government departments, primarily engaged in surveying the vastness of Canada and in conducting forest management.

Thanks to a postwar Imperial gift of aircraft, the Royal Canadian Air Force (RCAF) came into being in 1924. However, it had few military functions until 1936 when the Department of Transport emerged to handle the civil side. When war broke out in September 1939, the RCAF had only eight regular squadrons and 53 combat aircraft amongst a total of 270 planes. What saved the RCAF and made it a formidable force was the British Commonwealth Air Training Plan (BCATP) negotiated in Spring 1939. Schools were established from coast to coast; they especially dotted the Plains provinces. Milberry sketches the story extensively through training at Initial Training Schools (the Elementary and then Service Flying Schools in the two-stage British system), followed by Operational Training Units, and then posting overseas to squadrons of the RAF and RCAF (these were readily distinguished by their 400-series numbers. However, more coverage on the training and service of the ground crews would be complementary.

Milberry has a great eye for anecdotes, people, aircraft, and scenes. The books combine readable text with a pletho-

ra of photos that are well-captioned and informative. There is much in both of these books about early aviation in our northern neighbor. Browse, read, enjoy.

Robin Higham, Professor Emeritus, Military History, Kansas State University, Sometime BCATP Graduate



**International Cooperation with Partner Air Forces.** By Jennifer D.P. Moroney, et al. Santa Monica, Calif.: RAND Corp., 2009. Tables. Diagrams. Bibliography. Pp. xxiii, 130. \$37.50 ISBN: 978-0-8330-4571-3

Current fiscal restraints and shrinking military budgets make facing the asymmetric and emerging threats of today's world an increasingly difficult proposition. As a result, the U.S. must increasingly turn to allies, build cooperation, and increase partner capacity to adequately address strategic security concerns. The authors examine Air Force efforts in this arena and seek to "help the Air Force refine its ability to work by, with and through allies and partners through focused efforts to build their capacity."

The main audience is the Deputy Under Secretary of the Air Force/International Affairs (SAF/IA) who is "responsible for oversight and advocacy of Air Force international programs." SAF/IA manages a database, known as Knowledgebase, to track security assistance program information. The authors use this as the basis for their analysis as well as a recommended focal point for implementation of future programs.

The monograph first lays out key terms, examines why and how USAF is involved in security cooperation, and presents assumptions and objectives. The intention is to "Identify and analyze ongoing Air Force efforts around the world as a snapshot in time, outline the key elements of an approach that builds on SAF/IA's accomplishments and is responsive to U.S. strategic requirements, and recommend ways to implement the approach." The next two chapters lay out, through a macro- and micro-level examination, current USAF efforts in building partner relationships; while the fourth chapter briefly looks at the partner-building programs of other organizations within the DOD and allies. The final two chapters lay out findings, conclusions, and recommendations.

The team adequately identifies current USAF programs and provides recommendations for improving future programs. But it does not tie current pro-



grams to future recommendations very well, particularly in relation to what SAF/IA has accomplished in its oversight role, nor does it provide a compelling link between partnership-building programs and U.S. strategic interests. There are several reasons for this: (1) inconsistent and incomplete application of strategy, collection of data, and oversight within the myriad Air Force partnership building programs, (2) team failure to adequately account for political and cultural reasons behind success or failure of any particular partner-building program, and (3) the monograph's layout.

There are literally hundreds of programs, past and present, outside SAF/IA's purview: some handled by other DOD agencies (e.g., Air National Guard, other services), and some brokered through other allies, such as NATO. As a result, it is difficult for any one agency to adequately direct, track, or gather information on all of the programs. Additionally, no one DOD entity monitors or gathers data and lessons-learned on all of the Department's partnership programs. As a result, the study is not truly able to compare the full spectrum of partner-building program data accurately. Furthermore, there seems to be little evidence offered that any DOD agency (SAF/IA included) is using resources available at the State Department, other executive departments, or non-governmental agencies when initiating, managing, or assessing partner programs. As a result few data that hold across the board exist for RAND to build on, and there is little likelihood that any recommendations implemented at SAF/IA will have broad-reaching strategic effects on U.S. partner programs. Furthermore, with no one agency responsible for implementing strategic guidance into partner programs, the responsiveness and lag time inherent in the study's findings show a system that may not be truly capable of executing Strategic U.S. guidance at ground level.

Other reasons why the study's findings—and potentially the effectiveness of Air Force partner programs—fall short is failure to adequately account for political or cultural effects. In fact, one portion of the study points out an "Across-the-Board Review" that was conducted of one particular program, the intent being to take a "fresh look at the issues" but "minus the political baggage." However, cultural and political differences and motivations of potential or current partners may be the root cause of a program's failure to achieve its objectives. In short, the study and, perhaps by extension, USAF may be short-changing their looks at cultural/political motivations in partner programs.

However, the study's biggest deficit is

its organization and length. Although much data was presented, the internal divisions and sections made for a choppy, disjointed read. While the findings and recommendations make compelling arguments on their own, there is little connection to the macro/micro analysis earlier in the work. Similarly, adequate discussion is not given on how USAF develops specific partner programs based on strategic guidance, particularly in the case studies presented. Furthermore, the early chapters jump through a huge number of topics in a mere fifty-odd pages. The space provided is not sufficient to allow a successful tie-in to the follow-on chapters. This is particularly true of the fourth chapter, which seems to simply present other DOD and allied programs with little connection or support in any other section.

All in all, the study offers only a short peek into the vital world of U.S. and Air Force partner-building activities. Perhaps, in a different approach with expanded arguments, this study could indeed provide critical recommendations for future programs. As it stands, it is simply sufficient, presenting some data and providing some recommendations but falling down in its effort to "form a comprehensive package for developing and implementing an enhanced approach to Air Force security cooperation."

*Maj. Matthew Dietz, USAF, F-15E Pilot,  
NATO Combined Air Operations Center,  
Poggio Renatico, Italy*



**Submarine Operational Effectiveness in the 20th Century: Part One (1900-1939).** By Capt John F. O'Connell, USN (Ret.). New York: iUniverse, 2010. Maps. Diagrams. Notes. Glossary. Bibliography. Index. Pp. xii, 325. \$23.95 Paperback ISBN: 978-1-4502-3689-8

Submarine technology has evolved at a tremendous pace over the last century and a half. From the first successful attack on an enemy vessel by a submersible during the U.S. Civil War, to today's sleek, powerful, and devastatingly destructive ships, the submarine has become a lynchpin in the naval arsenal of every major power and both a potent symbol and a threatening tool for those who seek to achieve greater influence in their region or the world. Captain O'Connell discusses the evolution of submarine warfare theory and then assesses operational effectiveness during most of the first half of the 20th century.

Many are familiar with Germany's efforts during the First World War to starve England into submission using unrestricted submarine warfare. Many more have at least heard of the *Lusitania*, an ocean liner sunk by a U-boat without warning early in the war. What many do not know, is that all major belligerents used submarines in that war; most were rapidly developing this technology prior to the conflict. In synopsis form, O'Connell takes the reader through submarine development and employment broken down chronologically and by nation within each time frame. He discusses technologies unique to the various models, including weapons and hull design, pointing out strengths and weaknesses based on the actual use at sea and in combat. The activities of the various navies and specific exploits of particular submarines representing the use of that class or type of boat are pointed out as well. O'Connell gives equal treatment to the activities of all powers based on the respective level of their submarine arm's activities. He discusses little known operations in the Baltic and the Sea of Marmara in the Dardanelles during World War I and shows the impact these operations had on the warfighting strategies of the countries involved. A discussion of submarine activities conducted during the Spanish Civil War completes this volume.

The book is a quick read and easily digested in a weekend. There is a great deal of information, but the book does not have the dense feel of so many reference books which rely on dry facts and the reader's enthusiasm for the subject to carry them through it. That being said this is really only a primer on the subject. O'Connell's introduction states very little has been written on the development of submarine theory; and, while this book is a useful start, it is not the last word. *Sir John Fisher's Naval Revolution* by Nicholas Lambert is a good contribution to that literature with a useful and detailed discussion of this important naval thinker's ideas on Britain's development and employment of this then-new naval weapon. O'Connell's narrative is somewhat spotty and the author tends to mix stories which can be confusing. References are entirely secondary. He explains in the introduction the maps are hand drawn and, therefore, not to scale; but their amateurish look doesn't match the overall quality of this book. As an airman, I'm biased, but his reference to the big three of early airpower theory (Douhet, Trenchard and Mitchell) as snake-oil salesman, the use of slang without definition, and several statements not supported by references detract from the credibility of an otherwise excellent work.

O'Connell is a veteran of the submariner and has obviously done his homework. The information is detailed and comprehensive, and he meets his objective of assessing the submarine's early operational effectiveness. He even points out the British Admiralty's obvious failure to learn from its own success. They successfully interdicted Germany's Baltic shipping until Germany introduced convoy operations, but the Admiralty failed to pick up this lesson initially when Germany renewed unrestricted submarine warfare in 1917. This is the first of three books on the subject, and I look forward to seeing the next one. Of note this is also available through the publisher as an e-book.

*Lt. Col. Golda Eldridge, USAF, (Ret.)*



**Fighter Pilot: The Memoirs of Legendary Ace Robin Olds.** By Robin Olds with Christina Olds and Ed Rasimus. New York: St. Martin's Press, 2010. Photographs. Index. Pp. xiv, 400. \$26.99 ISBN: 978-0-312 56023-2

This is an engrossing memoir of a bona fide hero whose accomplishments spanned combat from World War II through Vietnam. Based on Robin's recollections in his eighty-third and last year, and enhanced by daughter Christina's devoted writing that relied on "boxes of diaries, military documents, films, letters, interviews, articles and photographs," the result is an engrossing, engaging, man-sized stereotype of an American fighter pilot. This well-written volume details his early recollections as the son of an Air Corps general, through football and West Point, becoming an ace in World War II, and serving in a variety of flying and staff assignments including Commandant of Cadets at the Air Force Academy. A reader will be hard pressed to find more graphic descriptions of the physical and emotional conditions of aerial fighting than contained in this volume.

The strains of marriage to movie star Ella Raines, both spouses' overuse of alcohol, and Robin's infidelity are unabashedly chronicled. Olds had little difficulty in adjusting to the vast technological changes wrought in aircraft, avionics, ordnance, and combat tactics over the years. Like many operators in the field, however, he had much more angst and little patience in accepting or adapting to new national strategies and resulting tactical changes required at the implementation level. Although he had unbridled admira-

tion for bomber crews in the war, he had little use for them and their policies after they became Air Force chiefs. There are few grays in Olds' life, and he recounts being more than willing to express his very positive views at all levels, including to LBJ in the Oval Office on the conduct of the Vietnam War. The reader learns of Olds' perceived drudgery as a staff officer wherever assigned and his uneasiness as the husband of a very social public wife.

However, not all the aerial or even earthbound yarns spun here may be accepted as gospel. For example, Olds recounts that in 1944, while stationed in a training unit and yearning for combat, he and a buddy traveled on their own initiative to the nearby higher headquarters and there found a receptive NCO who issued orders on the spot reassigning them along with six absent buddies to a fighter unit being readied for immediate overseas deployment. Equally implausible is Olds' account of taking the Group Intelligence Officer from their English base on an unplanned, unescorted, and unauthorized single-ship sortie over heavily defended, enemy-occupied Amsterdam before shooting up a train and returning safely, illustrating to the officer the difficulty of remembering the minute intelligence details asked of pilots returning from combat. This is not to question Olds' veracity or unwitting embellishment of actual events. We octogenarians sometimes now recall that the Bf 109s were much more numerous, that the flak was a great deal heavier, and that English women and their beer were both warmer than was true. By pure coincidence, I arrived in England as a fellow lieutenant in 1944 to begin a B-17 combat tour within days of Olds' starting his. Both of us finished our tours within days of each other.

Minor errors of dates and unit designations are inevitable but do not detract from this extremely well-written, easily read, and, at times, moving description of this American fighter pilot's ethos. Olds' narrative makes clear his pride in, and love for, his country and family and of having lived what he felt was man's highest calling—serving as a fighter pilot. He, like most of his colleagues, loved living fully on the edge and may well represent a dying breed threatened by RPVs, changed strategy, and new weapons systems. However, we can only hope that their unabashed boldness, professional skills as airmen, seemingly unlimited courage, esprit de corps, immodesty, derring-do, and patriotism will endure.

*Maj. Gen. John W. Huston,, USAF (Ret.), former Chief, Office of Air Force History*



**The Jet Race and the Second World War.** By Sterling Michael Pavelec. Annapolis, Md.: Naval Institute Press, 2007. Photographs. Appendices. Index. Pp. vii, 227. \$19.95 Paperback ISBN: 978-1-59114-666-7

During the latter part of the Interwar Years, the Germans led the initial efforts in harnessing jet propulsion technology, with the British trailing only slightly behind. However, by the end of World War II, the United States had soared past both to take the jet age into the Cold War era.

In this book, Dr. Pavelec, a professor of air power history at the School of Advanced Air and Space Studies, Maxwell AFB, examines the evolution of jet-powered technology from 1919 through World War II. He begins by explaining that the Germans, prevented from building military aircraft by the Treaty of Versailles, enthusiastically invested in jet-propulsion research and development during the Interwar Years. Led by Dr. Hans Pabst von Ohain, German engineers pioneered the jet. "Because the Luftwaffe had to start literally from scratch, by the 1930s there was little sentimental baggage from the first air war to hinder development or design." In addition, Pavelec contends that the Germans simply had the best scientists for the task. Moreover, their motivation also spurred them forward as they "needed the jet program to reach fruition." The Germans relied strongly on jet technology in order to offset their shortcomings in manpower and industrial capacity.

Also during the Interwar Years, the British, under the tutelage of engineer Frank Whittle, led the Allied efforts in jet technology. Competitive rivalries, funding issues, and simple lack of interest in the program hindered their efforts, however. Despite these limitations, the British designed and produced an operational jet prior to the end of World War II—the only Allied power to do so.

In turn, the British jump-started the American jet program by loaning their design to U.S. scientists. The American program had many advantages including a wealth of materials, excellent security, and unhindered industrial capability. With the help of the British, the Americans were able to produce a jet during the war but were unable to deliver an operational version before termination of hostilities. Pavelec writes that, despite their slow start, "by the end of the war, the United States had the most active jet program."

Pavelec convincingly illustrates just how crippling the overall allied offensive, especially the Combined Bomber Offensive, was in damaging the *Luftwaffe*. While the Germans were the first to send

an operational jet fighter into combat, their efforts were plagued by numerous factors such as design flaws, low production numbers, and lack of fuel. Worst of all, Hitler dictated that the new Me 262 be used as a bomber, demonstrating his inability to grasp, or accept, the threat of the Combined Bomber Offensive. Only after Minister of Armaments Albert Speer convinced him otherwise, did Hitler finally recant his previous order and allow the Me 262 to be built as a fighter.

The Allies' sheer industrial capability encumbered German efforts more than any other factor. Even though the Me 262 enjoyed a 2.3 to 1 kill ratio over American and British piston aircraft, Pavelec explains that the Germans could not keep up with them in aircraft production, thus offsetting any value-added in having jets in the first place.

Although Dr. Pavelec delivers a well researched and thorough study of jet-power technology prior to, and during, World War II, his scholarship is technically overwhelming at times. For example, the flow of the narrative is often packed with details such as "the prototype Jumo 004 had an eight-stage axial-flow compressor, eight annular combustion chambers, and a single exhaust turbine" or "the shaft speed of the Jumo 004 was estimated at 16,000 rpm, and the designed thrust rating was 900 kg (1,980 lbs.)."

Pavelec's research is replete with both primary and secondary sources as well as a wealth of excellent explanatory essays in the appendices. In one example, he explains the basic differences between centrifugal-flow turbojet engines and their axial-flow counterparts. While this information is crucial in understanding the basics of jet engines, it would have better served the reader by being integrated into the narrative. Despite these minor issues, Pavelec's book is a phenomenal study of the jet race and should be considered as a supplementary text for any college air-power course.

*Maj. Matt Basler, Assistant Professor of History, U.S. Air Force Academy*



**The Nuclear Express: A Political History of the Bomb and Its Proliferation.** By Thomas C. Reed and Danny B. Stillman. Minneapolis: Zenith, 2009. Photographs. Notes. Appendices. Glossary. Index. Pp. 392. \$30.00 ISBN: 978-0-7603-3502-4

Nuclear weapons and their proliferation continue to loom large as one of the

greatest threats to U.S. and global security. It is also an area most of us know very little about, and what we do know is often gleaned from the newspapers or even movies. This book fills the gap for a readable and comprehensive work for the military professional or layman with a limited background or knowledge in the areas of nuclear weapons and their proliferation. The information is thorough, accessible and readable. Technical explanations are clear enough to help one understand the issues without burdening the reader with unnecessary details of weapons design. There are a few issues with perspective; but, overall, this is an excellent primer from some real subject-matter experts.

The authors are eminently qualified to write this book. Thomas Reed is a nuclear weapons designer, former Secretary of the Air Force, and Special Assistant to the President for National Security Policy; while Danny Stillman is a physicist who ran the Los Alamos Technical Intelligence Division for thirteen years. Much of the information related comes from the authors' personal experiences providing for the unique first-person perspective often missing in these types of works. The authors do present their particular perspective on the current trends in nuclear proliferation, but it isn't so biased that it detracts from the book's readability or the authors' conclusions.

This book is a combination chronological narrative and country-by-country discussion of the development and proliferation of nuclear weapons. In the prologue, the authors state their opinion that both extremist Islamist terrorists and the Chinese are the main threats to world peace and security vis-à-vis nuclear weapons. Terrorists are a threat because of their desire to strike using any weapon available, and the Chinese because of their apparent lack of concern for the consequences of indiscriminately sharing nuclear weapons technology. This thread continues throughout the book. The narrative's tone is journalistic which makes for an easy read, and technical discussions are couched in easy-to-understand language. Weapons design discussions are specific enough to help the reader understand why one type of weapon is a proliferative threat and another isn't but are not written so as to lose one in the minutia. The book's scope is broad enough to encompass the spectrum of weapons development and proliferation but specific enough to zero in on what the authors see as the continuing major areas of concern.

The book has several flaws that—

while not negating the book's value—do detract somewhat from the arguments' force and credibility. The footnotes are limited to explaining terms or names with very few citations for sources. When sources are cited, they are very often newspapers and, in one case, even a popular movie. I found this surprising given the authors' backgrounds and credentials. The authors frequently allow a moralizing tone to creep into the narrative which, given their credentials and knowledge, isn't necessary. When they feel compelled to state a position, their arguments and backgrounds are strong enough to carry it without a moralizing tone. Opinions are sometimes interspersed in factual discussions; this makes for an uneven narrative consistency.

Despite these issues, the book is an excellent discussion of the issues involved with nuclear weapons development and proliferation and provides significant insight into where the threats exist and are likely to develop further. Given the renewed emphasis on the U.S. nuclear arsenal and its safety, reliability and potential uses—much of which is entrusted to the Air Force—this is a timely and informative book.

*Lt. Col. Golda Eldridge, USAF (Ret.)*



**Master of the Air: William Tunner and the Success of Military Airlift.** By Robert A. Slayton. Tuscaloosa: The University of Alabama Press, 2010. Photographs. Notes. Appendices. Bibliography. Pp. xii, 251. \$43.50 ISBN: 978-0-8173-1692-1

This book is the first full-length biography of General William Tunner, undoubtedly best known as the leader of the Berlin Airlift of 1948-49. It covers the general's career in a standard chronological fashion. Most of the main events are probably known to most readers—the Hump Airlift, Berlin Airlift, and combat airlift and transport operations in Korea. Many readers will also be aware of some of the innovations in operating and maintenance procedures instituted by Tunner that lead to successful airlifts—especially Berlin—when conventional wisdom said it couldn't be done. After the Berlin and Korean airlift operations, Tunner was certainly the world's foremost airlift expert and leading advocate of equipment, tactics, techniques, procedures, and maintenance practices that revolutionized airlift. To a large degree, these are still in place today. Tunner retired as a lieutenant gen-

eral in 1960 as Commander, Military Air Transport Service, predecessor of Military Airlift Command and Air Mobility Command.

Although there is nearly nothing in the book beyond Tunner's professional career—no mention of personal aspects of his life—the book does use a number of quotations from his second wife, Ann, who outlived him by many years. Still, these insights relate to his career and professional life. There is an interesting chapter-long sidebar about his role in supporting women pilots in the Ferrying Command just before and during the early days of World War II.

Slayton portrays Tunner much as Tunner portrayed himself in his autobiography, *Over the Hump*—as a person who imposed a logical business approach to managing operations and maintenance. Slayton relies heavily on *Over the Hump* as well as interviews with surviving colleagues and subordinates. He paints Tunner as a man who had a single-minded focus on military airlift, and one who would go to any lengths to promote it—even at the expense of angering superiors and hindering his career. He frequently uses the word entrepreneur to describe Tunner, though a better term may be innovator or even radical innovator. Slayton says Tunner's approach was unmilitary; but his management innovations, while perhaps viewed as extreme at the time by many, do not seem out of line. In fact, centralizing maintenance, expedited loading and unloading of aircraft, requiring aircraft to return to West German bases after a single missed approach, set takeoff times, and use of radar approaches seem mainstream today.

Tunner's leadership actions seem just as appropriate now, however unpopular they were in their time. After encountering rock-bottom morale in India when he took over the Hump Airlift in 1944, the general ensured all the sad sacks were cleanly shaven and that officers participated in parades every Saturday. He emphasized safety and the importance of weather's influence on operational decisions. He also instituted a rescue organization to somewhat ease the minds of crews flying in difficult weather conditions over such forbidding territory. It is hard to argue that Tunner's career was unsuccessful: retiring as a three-star general atop a major command after 32 years hardly seems a less-than-successful career!

A number of minor errors should have been caught by more astute editing. Examples include sending aircraft back to the States for 1000-mile heavy maintenance (1000 hours), six C-74 sorties on a single day of the Berlin Airlift flew in

250,000 tons (pounds) of coal, and setting the number of casualties airlifted out of Korea at 314,000 (other sources list the total number of troops wounded in action for the entire war at about 95,000). A couple of maps would also have helped the presentation.

Despite these minor shortcomings, the book makes interesting reading. One can decide if Tunner's approach to leadership and management was radical and unconventional—or perhaps just innovative and ahead of its time.

*Col. Stetson M. Siler, USAF (Ret.)*



**Fire from the Sky: Surviving the Kamikaze Threat.** By Robert C. Stern. Annapolis, Md.: Naval Institute Press, 2010. Photographs. Notes. Appendices. Bibliography. Index. Pp. 384. \$49.95 ISBN: 978-1-59114-267-6

Over more than twenty years, Stern has written dozens of monographs that deal mostly with twentieth century naval vessels and naval warfare. In this book, he provides an extremely detailed look at the losses inflicted on the U.S. and British navies by Japanese suicide pilots in the final year of World War II. He carefully defines the scope of his treatment—the impact of the *tokkotai* (special-attack units) beginning in the Philippines in October 1944. Other weapons, such as explosive-laden speedboats and mini subs, are excluded. He also attempts to dismiss isolated instances of pilots, operating in regular bomber and fighter squadrons, who crashed their aircraft into enemy vessels. This work focuses almost entirely on the damage inflicted on the targeted ships. Consequently, the impact of offensive and defensive Allied air operations is ignored for the most part.

In the first two chapters, Stern briefly examines the nature of suicidal attacks in warfare and why Japanese leaders—increasingly desperate after the decimation of their naval aviators in the June 1944 Battle of the Philippine Sea (also known as the Great Marianas Turkey Shoot)—regarded organized suicide attacks as their best strategic option to avoid the shame of unconditional surrender expected to be imposed by the victorious Allies. Two chapters discuss the evolution of Japanese tactics at various stages in the suicide campaign, and a final chapter examines the strategic impact. But the balance of the book provides, in great detail, virtually all suicide attacks on vessels supporting ground operations in the Philippines, Iwo

Jima, and Okinawa and its nearby islands. To accomplish this, Stern obviously spent countless hours gleaning information from after-action reports filed in the National Archives. In addition to the narrative, he includes nearly 200 photos and plots of evasive action taken by individual ships to avoid attacking aircraft.

For convenience, Stern identifies all Japanese aircraft by their Allied code names: one of the book's three appendices provides a brief description of each type. Stern's other appendices explain the U.S. Navy nomenclature used to identify various classes of landing ships and provide a list of all vessels lost to the *tokkotai*.

While serious students of the Pacific War, particularly its final year, will find this work valuable, the absence of maps is a serious shortcoming. They would have been helpful in providing the reader recognition of the significance of various anchorages and also an appreciation of the concentration of attacks during a particular ground campaign. Perhaps because the book was first published in Great Britain, distances and heights in the narrative are usually measured in kilometers and meters; whereas the U.S. after-action reports, when cited verbatim, naturally use miles, yards, and feet.

*Lt. Col. Steve Ellis, USAFR (Ret.), docent, Museum of Flight*



**The Engines of Pratt & Whitney: A Technical History.** By Jack Connors. Reston, Va.: American Institute of Aeronautics and Astronautics, 2010. Tables. Diagrams. Illustrations. Photographs. Appendix. Bibliography. Index. Pp. xvii, 527. \$49.95 ISBN: 1-60086-711-8

This may be one of best books I have read in a long time. Jack Connors is well qualified to document the history and technology of one of the great companies in aviation history. He was an engineer, program manager, and marketer in the company for thirty-five years. In retirement, he organized Pratt's dormant archives and talked with many former and current employees.

Pratt & Whitney was the brainchild of the president of Wright Aeronautical, Frederick Rentschler, who saw the future of aviation lying in the air-cooled radial, not the liquid-cooled engine as his board wanted. Dissatisfied, he left—with several of the key people in the company—and founded P&W. Their first product, the R-1340 Wasp, was a landmark in engine technology and established Pratt's reputa-

tion for delivering dependable aircraft power. Connors covers each of the engine models that came out of the company during the next eight decades. He also shows that the marriage of Pratt & Whitney and Boeing was a major influence on the development of commercial aviation.

The company's contributions to World War II are nothing short of astounding. P&W and its licensees produced 363,619 aircraft engines that powered about sixty different aircraft types. The power output of these was more than 600 million horsepower, about the same as all other manufacturers' output combined. When the war was over, however, Pratt found itself way behind the power curve in the technology of the future—turbine engines. The great leap occurred with development of the twin-spool J57, the engine that laid the foundation of most of today's propulsion systems. In the late 1960s and early 1970s, the high-bypass-ratio JT9D for the 747 and F100 engine for the F-15 were additional giant leaps ahead. Pratt & Whitney continues today to produce dependable engines for a wide range of aircraft.

So what makes this history such a standout? There are a number of features I thought were great. First, for each engine discussed, Connors provides a table of all the models, the aircraft they were used in, and a timeline bar that summarizes the engine's history. Second, these timelines are used for not only each engine, but also for areas such as various technologies or overviews of particular eras—anywhere a bunch of dates are involved in the text, Connors gives a timeline chart to put the major events into perspective. Third, one might expect a P&W engineer to tell how wonderful his company is and how lousy the competition's products were. Not once did I find anything derogatory about Allison, Wright, GE, or Rolls Royce. To the contrary, Connors often notes where another company was ahead and how that may have spurred P&W into action. Fourth, while this is titled a technical history, it is not a college engineering text. The technical aspects are covered simply and clearly. His explanations of why piston engines work and why they have parts made the way they are are excellent. Fifth, the story of the business aspects of the aviation industry is just as important as the technical aspects he covers. Why were certain technologies pursued? How were decisions made at the very top to take the company in directions that might end up in total failure?

Finally, the last chapter of the book is "Looking Back 80 Years." This one chapter is worth the price of the book by itself. It provides a wonderful look at where aviation has gone in a century and makes an

excellent case for the fact that propulsion advances have been the prime driver in the rapid development of aviation.

This excellent book will serve as a fine reference volume for years to come

*Col. Scott A. Willey, USAF (Ret.), Book Review Editor*



**Robert Taylor's Battle of Britain Commemorative Collection.** By Robert Taylor. Published in the United States by Casemate Publishers, 2010. Illustrations. Index. Pp. 128. \$34.95 hardback. ISBN-13: 978-1-935149-32-3

One of the world's premier aviation artists, Robert Taylor is best known for his realistic renderings of World War II airplanes and aerial combat. In this new "coffee table" art book, he has compiled over 30 examples of his paintings in honor of the 70th anniversary of the Battle of Britain. Each chapter includes art prints of finished paintings and preliminary sketches, as well as biographical details on many of the pilots Taylor interviewed during his research. The reader learns about not only the epic contest between the British Royal Air Force (RAF) and the German Luftwaffe during the summer of 1940, but also the artistic process by which Taylor turns a pilot's combat report into art. The paintings range from "Hurricane Force," which depicts in vivid detail a battle between RAF Hurricane fighters and Luftwaffe bombers over London at the height of the battle, to "Summer Victory," showing RAF Spitfires flying over a Luftwaffe Messerschmitt Bf 109 that has just crashed in a wheat field. Most paintings are based on an actual event and required Taylor to research the airplanes and pilots involved. "Summer Victory," for example, was based on an incident recalled by Alan Deere, a New Zealand ace, as he returned to his airfield. Taylor is especially gifted in his ability to blend clouds, sun, and sky into a realistic, yet beautiful, backdrop to the aerial action taking place.

The quality of the book is first-rate, including the art printing and commentary by Taylor. Readers versed in the history of the Battle of Britain may not garner much new information about the battle, but they will marvel at the beauty of Taylor's art. This book is homage to the legendary pilots and airplanes that fought in the skies over England 70 years ago. Winston Churchill remarked that "Never in the field of human conflict was so much owed by so many to so few." As the last the surviving "few" pass into history we are

fortunate that their courage and sacrifice have been memorialized by Robert Taylor.

*Maj. Jeffrey P. Joyce, USAF (Ret)*



**Freedom Flyers: The Tuskegee Airmen of World War II.** By J. Todd Moyer. Oxford, Oxford University Press, 2011. Illustrations. Notes. Bibliography. Index. Pp. 241. \$24.95 ISBN: 978-0-1953-8657-4

*Freedom Flyers* is the best book to date about the Tuskegee Airmen. Dr. Moyer has nailed the saga, punctured numerous myths, and provides the whole story, including the significance of the Tuskegee Airmen for United States domestic politics and culture.

Among many things to admire is the front of the dust jacket (something seldom, if ever, mentioned in a review): Moyer represents the Tuskegee Airmen by displaying five enlisted Tuskegee Airmen maintaining an aircraft or searching the skies for the return of their warbirds. Seldom does any author writing about black aviation units mention the *indispensible* enlisted personnel. About 990 pilots graduated from Tuskegee Army Airfield. They served in the four fighter squadrons and also the four B-25 squadrons (which did not fly in combat). Another several hundred officers were trained (at bases other than Tuskegee Army Air Field) to be navigators and navigator-bombardiers who were trained

There were also more than 13,000 enlisted men who supported them. When the Tuskegee Airmen received The Congressional Gold Medal from President George W. Bush its engraved face had three individuals: a fighter pilot, a bomber officer crewmember and between them an enlisted man. Thank you J. Todd Moyer for recognizing the enlisted personnel. His book tells the reader about all Tuskegee Airmen.

The author better than virtually all who have published on this subject recognizes the connection between American domestic politics and President Franklin D. Roosevelt's election-politics-driven promise in 1940 to open Army aviation to blacks, and President Harry S Truman's similarly motivated 1948 Executive Order 9981 calling for equal opportunity—not racial integration—in the armed forces. Furthermore, Moyer appreciates the essential nature of Col. Noel Parrish's leadership skills to the success of the flight training of the pilots and their maintenance crews. He, moreover, displays in appropri-

ate detail the combat success of the Tuskegee Airmen in North Africa, Sicily, and Italy. Moyer perceptively analyzes the Freeman Field Mutiny in 1945, telling the story objectively. He is sensitive to the role the Tuskegee Airmen played in armed forces racial integration and the nuanced activity of President Truman (although I believe he is overly generous to Truman). Moyer gives the proper credit for Air Force racial integration to Lieutenant General Idwal Edwards, Air Force Deputy Chief of Staff for Personnel. Edwards drove this reform from start to finish and has never received proper credit in a general history of the Tuskegee Airmen. Moyer has plumbed the depths of primary sources at the National Archives, the Air Force Historical Research Agency archives at Maxwell Air Force Base, Alabama, the Library of Congress and elsewhere. He uses many pungent quotations to brighten the story.

The last point in the previous paragraph is also a weakness. Moyer is truly a professional historian, but this reviewer believes he has overused oral history. I interviewed many people he cites and the stories they told me were often slightly different, and sometimes factually wrong. Memory, it is said, seems to improve with age, but we all know memories fade with age. Oral history is almost always self-serving and must be used with care. The fundamentals of Moyer's story are not distorted by oral history, but more care needed to be taken. For one telling example, the author uses interviews to describe the purpose of Army "Regulation 210-10" promulgated in late 1940. The Tuskegee Airmen assert (and so does Moyer) it was written to permit blacks officers to use Officer's Clubs. There were, however, only two black operational officers in the Regular Army then, and the purpose was to ensure the various branches (artillery, infantry, cavalry, etc) did not exclude officers from other specialties from officer's clubs annexes. Minor point, but it is an issue needing to be made. There are other examples where Moyer relies on the Tuskegee Airmen to cite motivation or facts which are erroneous, but, as I said previously, the fundamentals of the account are sound.

Finally, Moyer sensitively and accurately portrays the current noisy discussion on the accuracy of the claim the Tuskegee Airmen escort fighter pilots never lost a friendly bomber to an enemy fighter. The assertion by the men of the 332d Fighter Group and many historians is sixty years old and Moyer objectively puts the matter in perspective. I leave it to the readers of *Freedom Fliers* to make their own judgment.

If you were to own one history of the Tuskegee Airmen, it should be this one.

*Dr. Alan R. Gropman is a retired colonel who wrote the history of Air Force racial integration and edited the U.S. Army Center of Military History's account of armed forces racial integration. He has also written extensively on the Tuskegee Airmen.*



**The Training Ground: Grant, Lee, Sherman, and Davis in the Mexican War, 1846-1848.** By Martin Dugard. New York: Little, Brown and Co., 2008. Maps. Notes. Appendices. Bibliography. Pp. xv, 447. \$29.99 ISBN: 978-0-316-16625-6

This is avowedly not a history of the Mexican War. However, it compares favorably with some I've read in Dugard's bibliography plus others not there, such as Prescott's *Conquest of Mexico*, which I read when young in our family library and music room. Dugard does a good job of providing the background of this war and a better job than most in describing Taylor's operations in Northern Mexico. He does touch rather lightly on Kearney's Expedition, and I found Colonel Doniphan only on the map inside both covers.

The book reads like a thriller. Dugard has made extensive use of personal letters and memoirs, and these serve to bring the characters he has chosen to life. His theme is the transformation, under fire, of innate potential into something different, and better, than that of contemporaries who have a similar starting point. There is an aphorism that Napoleon had a mule that

served in ten campaigns and was still a mule. Obviously the shared "training ground" of Mexico didn't prepare every trainee to rise above muledom. What we have here are some hints of moral courage, initiative, and introspection that give a clue to future performance.

From personal experience, I know how deep an impact the stress of combat can make on an individual, but I'm also aware that's not the totality of character formation. Much has happened before and, if you survive, a considerable amount will happen after. Dugard does cover this in a summary fashion. Even Freud would have trouble saying why Grant performed better than cadet number twenty-four or number twenty-six in his class at West Point.

One thing that struck me is that two future commanding generals of the U.S. Army missed combat in the Mexican War. Both Henry Halleck and William T. Sherman reached California after hostilities had ended there, left the Army, became major generals in the California militia, and were retreads in the Civil War (as were many others on both sides). As a Californian, I'm interested in their time there, and Dugard writes about the Gold Rush that attracted two of my ancestors. With the variety of sources, there are tidbits and anecdotes that are not commonly known, and this makes for entertaining reading. Because my son and I are Hereditary Members, I enjoyed reading about both the formation of the Aztec Club of 1847 by officers of Scott's army in Mexico City and some of the society's later activities.

For anyone interested in the Mexican War, this is highly recommended. The applications of lessons in the book to the Civil War are not completely clear, but that doesn't affect the enjoyment.

*Brig. Gen. Curtis Hooper O'Sullivan, ANG (Ret.), Salida, California*



# Books Received

Douglas, Graeme. *Boeing B-17 Flying Fortress, 1935 onwards (all marks) Owners' Workshop Manual*. Minneapolis, Minn.: Zenith Press, 2011. Illustrations. Photographs. Notes. Appendices. Index. Pp. 160. \$28.00. ISBN: 978-0-7603-4077-2

Hallock, Judith Lee, John C. Waugh and Drake Bush. *How Historians Work: Retelling the Past – From the Civil War to the Wider World*. Buffalo Gap, Tex.: State House Press, 2010. Photographs. Illustrations. Notes. Appendices. Bibliography. Index. Pp. ix, 282. \$24.95. Paperback ISBN: 978-1-93333743-2

Harvey, James M. *Sharks of the Air: The Story of Willy Messerschmitt and the Development of History's First Operational Jet Fighter*. Philadelphia and Newbury: Casemate Publishers, 2011. Photographs. Notes. Bibliography. Index. Pp. 402. \$32.95 ISBN: 978-1-935140-46

Kilford, Christopher R. *The Other Cold War: Canada's Military Assistance to the Developing World, 1945-1975*. Kingston, Ont.: Canadian Defence Academic Press, 2010. Notes. Tables. Bibliography. Index. Pp. vi, 318. Paperback ISBN: 978-1-100-14338-5

Raines, Edgar F., Jr. *The Rucksack War: U.S. Army Operational Logistics in Grenada, 1983* [Contingency Operations Series]. Washington, D.C.: Center of Military History, 2010. Maps. Photographs. Illustrations. Notes. Bibliography. Index. Pp. xxviii, 649

Record, Jeffrey. *A War It Was Always Going to Lose*. Sterling, Va.: Potomac, Books, 2010. Map. Notes. Bibliography. Index. Pp. xiii, 166. \$24.95 ISBN: 978-1-59797-6

Smith, Douglas V., Ed. *One Hundred Years of U.S. Navy Air Power*. Annapolis, Md.: Naval Institute Press, 2010. Photographs. Notes. Index. Pp. xv, 373 \$52.95 ISBN: 978-1-59114-795-4

Wildenberg, Thomas and Norman Polmar. *Ship Killers: A History of the American Torpedo*. Annapolis, Md.: Naval Institute Press, 2010. Photographs. Illustrations. Notes. Appendices. Bibliography. Index. Pp. xvi, 268. \$52.95 ISBN: 978-1-59114-688-9

**Have you read a very good or very bad book in air power history recently? Send your review to Col. Scott A. Willey, address below.**



## THE AIR FORCE

Edited by Gen. James P. McCarthy, USAF (Ret),  
and Colonel Drue L. DeBerry, USAF (Ret)

This is a large-format book published in preparation for the Centennial of Flight celebration in 2003 and makes a great gift for an Air Force member, retiree, or veteran. Westport, Connecticut: Hugh Lauter Levin Associates, Inc., 2002. Copyright (c) 2002 by The Air Force Historical Foundation. 368 pages with illustrations, table of contents, and index.

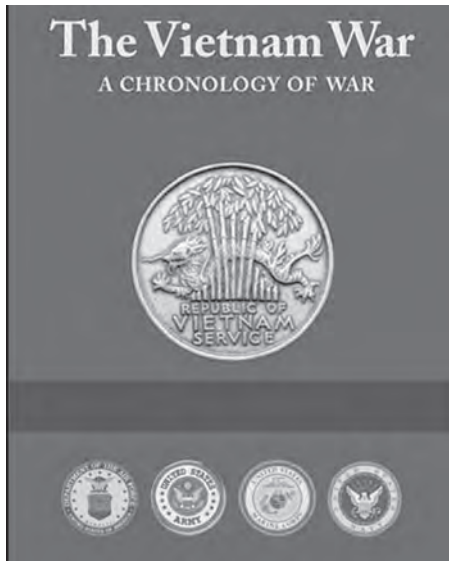
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Fairfax, VA 22033  
Tel. (703) 620-4139  
e-mail: [scottlin.willey@gmail.com](mailto:scottlin.willey@gmail.com)



## **THE VIETNAM WAR: A CHRONOLOGY OF WAR**

Edited by Col. Raymond K. Bluhm, Jr., US Army (Ret)

This is a richly-detailed, day-by-day account of significant Army, Navy, Marine Corps, Coast Guard, and Air Force events from the Vietnam War – from the role of military advisors to the 1975 fall of Saigon. Each entry is full of historical information and identifies the date, location, and military units involved, while introductory essays place these events within the context of the overall conflict. Published in cooperation with the Army, Naval, and Marine Corps historical foundations, this encyclopedic account of the history of the Vietnam War comes to life with original photos and colorful art from the collections of all four services and military artists.

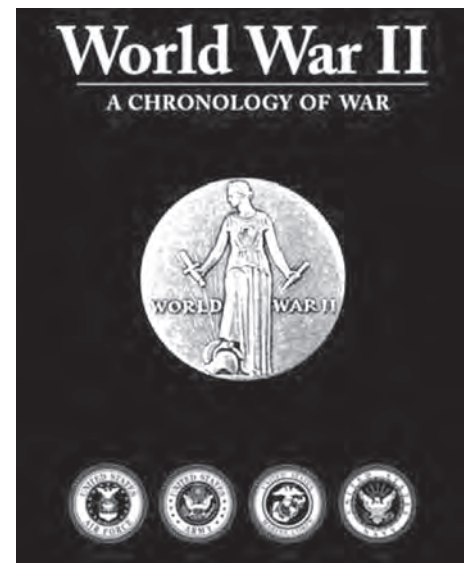
Price (until 12/31/11): \$50.00

## **WORLD WAR II: A CHRONOLOGY OF WAR**

Edited by Col Raymond Bluhm, US Army (Ret)  
(Westport, Connecticut: Rizzoli Publishers, Inc., 2008).

This is a large-format book—published in cooperation with the Army, Naval, and Marine Corps historical foundations—that will make a great gift for any military member, retiree, or veteran. The Air Force Historical Foundation is working in cooperation with the Marine Corps Heritage Foundation, the Naval Historical Foundation, and the Army Historical Foundation to produce a large-format chronological history of World War II. It is similar in format to the book "U.S. AIR FORCE: A COMPLETE HISTORY," which the Foundation published in 2006.

Price (until 12/31/11): \$60.00 including shipping



## **U.S. AIR FORCE: A COMPLETE HISTORY**

by Lt Col Dik Alan Daso, USAF (Ret).

This is a large-format book published in preparation for the 60th Anniversary of the United States Air Force celebration in 2007 and makes a great gift for a USAF member, retiree, or veteran. It is a chronological history of the Air Force from the early days of flight through the Wright Brothers to the Aviation Section and on to the United States Air Force through June 2006.

Westport, Connecticut: Hugh Lauter Levin Associates, Inc., 2006.

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624 pages with illustrations, table of contents, and index.

Price (until 12/31/11): \$50.00 including shipping

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## From the President

Dear Members:

Each of you played an integral part in the history and legacy of air power across the decades. In 2011, the Air Force Historical Foundation is looking to become an even more vital and dynamic resource for you in order to advance our essential mission: to preserve and promote the history, heritage, and legacy of our U.S. Air Force, its predecessors, and other military air services.

As with most other non-profit organizations, this still is a critical time economically. Consequently, it's even more important for our Foundation to remain relevant to our members and the Air Force. With your help, I'm confident that we can face today's challenges and emerge as an even stronger organization that better serves your needs while expanding our ability to preserve air power history.

In 2010, the Foundation reduced our operating expenses and aligned all organizational activity with our fiscal year. In addition to streamlining our processes, we stepped up our efforts to leverage the Foundation's website in expanding our services and member outreach. We also held a highly successful awards banquet during which our special guest, General Will Fraser, Commander of Air Combat Command, helped us honor the former Air Force Chief of Staff, General Larry Welch as the Gen. Carl "Tooey" Spaatz Award winner, and noted historian Dr. Alan Gropman with the Maj. Gen. I.B. Holley Award.

We have set our sights high for 2011. In the coming year, our outstanding *Air Power History* publication will continue to capture your attention with historical articles, eyewitness accounts, and regular features on new books, museum exhibits and meetings of interest. Our website will continue to develop, providing members with expanded articles, services and resources.

Return to [www.afhistoricalfoundation.org](http://www.afhistoricalfoundation.org) regularly for new stories, features, and information about upcoming events – including our upcoming 2011 symposium, which we will jointly sponsor with the Air Force Historian's Office.

We constantly are looking for innovative ways to make our organization more useful to you and to attract a wider audience and participation. Your feedback is of the utmost importance to our success. By all means, let us know of your suggestions to make our Foundation even better.



Dale W. Meyerrose, Maj Gen, USAF (Ret)  
President and Chairman of the Board



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**Air Force Historical Foundation**  
and  
**Air Force Historical Studies Office**  
Call for Papers

The Air Force Historical Foundation and the U.S. Air Force Historical Studies Office invite scholars, analysts, observers, and participants to submit proposals for papers to be presented at the 2011 symposium, “Air Power and Global Operations: 9/11 and Beyond,” which will be held November 17–18, 2011, in the Washington, D.C. area.

In recognition of the tenth anniversary of the events of September 11, 2001, this 1-1/2 day symposium will feature prominent U.S. military and civilian leaders, national security experts, and Air Force historians. Papers will consider topics of leadership, technology, doctrine, planning, operations, and roles and missions within the general theme of air power in the post-9/11 world:

**9/11 and Operation Noble Eagle**, including leadership and information management, interagency communication and coordination, evolution and expansion of the air defense mission, and budgetary impact on day-to-day operations.

**The Global War on Terror and Operation Enduring Freedom**, including increased heightened operational tempo, coalition interoperability, air mobility, special operations, and provincial reconstruction teams.

**Operation Iraqi Freedom and Operation New Dawn**, including counterinsurgency, joint aspects of major combat operations, nation-building, and air mobility.

**New Operational Paradigms and Innovations**, including the impact of precision weapons, ISR, command and control systems, satellite and communications systems, cyber warfare, and global humanitarian missions.

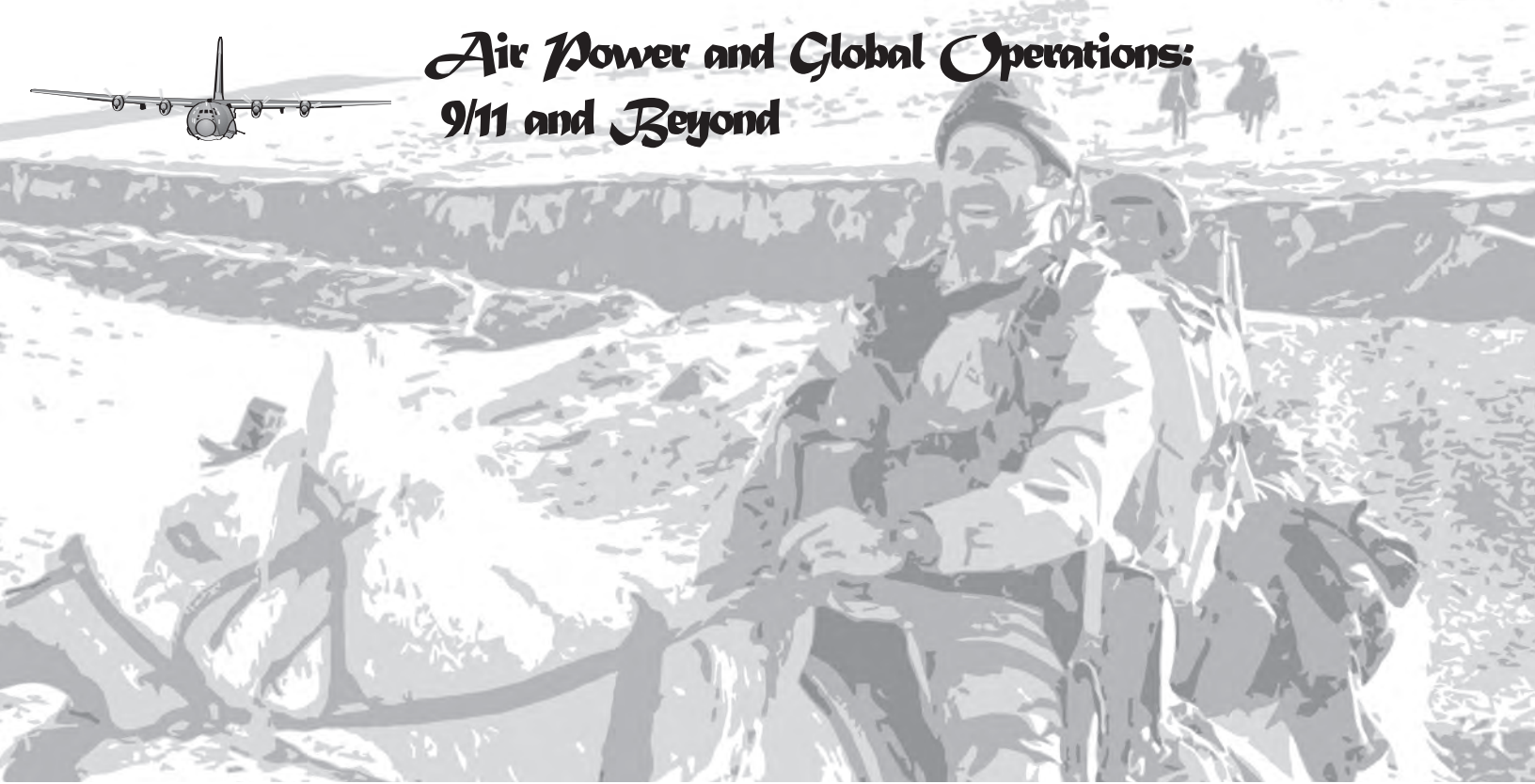
Time constraints may limit the opportunity to present some papers in person at the symposium. The Air Force History and Museums Program plans to publish an edited volume based on the proceedings. Thus, contributors unable to present papers will be able to share their work in the published symposium proceedings.

The conference sponsors are unable to provide transportation, food, or lodging for this symposium.

To be considered for the symposium, submit an abstract of approximately 250 words and a one-page *curriculum vitae* or resume to HOH.HistorySymposium@pentagon.af.mil by **May 1, 2011**. Please type “2011 Symposium” as the subject of the email. We plan to respond to proposals by mid-June. The final papers will be due by **October 2, 2011**.



# *Air Power and Global Operations: 9/11 and Beyond*



## **The Air Force Historical Foundation Symposium**

The Air Force Historical Foundation will sponsor its biennial symposium on Thursday and Friday, November 17-18, 2011, on the theme *Air Power and Global Operations: 9/11 and Beyond*. The symposium will take place at the Air Force Conference Center, Andrews AFB, MD, and will feature panels of historians, analysts, and leaders who have directed air operations in this period. Following the Symposium the Foundation will host its annual presentation of awards at a luncheon at Andrews.

The awards luncheon will feature the presentation of two prestigious awards. The fifth annual **General Carl “Tooey” Spaatz Award** will be presented to an individual for a sustained, significant contribution to the making of Air Force history during a lifetime of service, and is named for the first President of the Foundation and first Chief of Staff of the Air Force. Past recipients include General David C. Jones, Maj Gen John R. Alison, Lt Gen Thomas Stafford, and General Larry D. Welch.

The Foundation also will present its fifth annual **Major General I. B. Holley Award** to an individual who has made a sustained, significant contribution to the research, interpretation, and documentation of Air Force history during a lifetime of service. It is named for the distinguished professor who taught military history at Duke University for over six decades, served as an active and reserve Air Force officer, and influenced several generations of military historians. Past recipients include General Holley, Brig Gen Alfred F. Hurley, Herman S. Wolk, and Dr. Alan R. Gropman.

ONLINE REGISTRATION at [www.afhistoricalfoundation.org](http://www.afhistoricalfoundation.org) WILL BEGIN LATER THIS SPRING. Tables, continental breakfast, breaks, and the luncheon are available for corporate sponsorships. Further information is available by contacting **Jim Vertenten** at [execdir@afhistoricalfoundation.org](mailto:execdir@afhistoricalfoundation.org) or by calling (301) 736-1959.

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## Letters to the Editor

Letters may be sent to: [editor@afhistoricalfoundation.org](mailto:editor@afhistoricalfoundation.org) Submissions must be exclusive to *Air Power History* and include the writer's address and phone number. Letters are subject to editing and abridgement. Because of the volume of material we receive, we are unable to acknowledge submissions. However, writers whose letters are being considered for publication will be contacted.

## Corrections

I have to point out a minor correction to the caption on page 16 of the Winter 2010 issue [Vol. 57, No. 4]. The seaplane in question is not a PB2Y Coronado, but rather an XPB2M-1R. Originally built as a prototype patrol bomber by Martin (as the XPB2M-1), it was converted to a transport and redesignated as the XPB2M-1R. The production version was designated the JRM-1 Mars. Otherwise an interesting article.

*Bill Stubkjaer*, Curator, Moffett Field Historical Society, Moffett Field, California

## Sorry, Dan

We inadvertently omitted Dan Simonsen's name on the list of book reviewers for 2010 [*Air Power History*, Vol. 57, No. 4, page 61]. Lt. Col. Simonsen is one of our most prolific reviewers.

## News

## Last Doolittle Raiders Pilot

William M. Bower, the last surviving pilot of the Doolittle Raid, died on January 10, 2010. He was ninety-three. Only five of the Doolittle Raiders remain. On April 18, 1942, Jimmy Doolittle led a raid on Japan, in which sixteen Army Air Forces B-25s – land-based planes – took off from the USS *Hornet*. Although the attack caused only minor damage it was noteworthy as the first retaliation against Japan since the Japanese attacked Pearl Harbor on December 7, 1941. Moreover, the Doolittle Raid demonstrated that despite its string of victories, Japan was vulnerable.

## Did you fly a "Mission to Tokyo" during WW II?

I'm writing a book about B-29 Superfortress operations against Japan. "Mission to Tokyo" will be published by Zenith Press in November 2012. The focus of this book is the March 9-10 incendiary attack on the Japanese capital. However, the book will also provide a new history of the entire B-29 campaign.

I'd like to hear from B-29 pilots, crewmembers, support personnel, family members and historians. I'm looking for personal accounts, photos, memorabilia and documents. If you'd like to help with this new history, please contact me. Don't hesitate to pick up the phone.

Robert F. Dorr  
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## Beneficial Bombing

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MARK CLODFELTER

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J.D. Caven  
474 Brookhaven Ln.  
Sunrise Beach, MO 65079  
(573)-374-8275  
jcaven002@charter.net

**123rd AC & W Squadron (Landshut 1961-62)** March 29, 2011 Dayton/Fairborn, Ohio. Contact:

Patty Griffin  
PO Box 111116  
Cincinnati, OH 45211  
(513) 598-3432  
pgriffin@homecityice.com

**334th Tactical Fighter Squadron** May 10-15, 2011 Dayton, Ohio. Contact:

Bob Hipps  
3140 Ridge Drive  
Toano, VA 23168  
(757) 898-7548  
Wolf\_fac@yahoo.com

**497th TFS "Night Owls" Aircrews (1966-73 Ubon)** May 12-14, 2011 Dayton, Ohio. Contact:

Gordie Tushek  
605 Embassy Court  
Peachtree City, GA 30269  
(770) 631-4615  
OWLFAC@aol.com

**Air America Association** June 1-5, 2011 Dayton, Ohio. Contact:

Rob & Meri Noble  
926 - 120th Street NW  
Gig Harbor, WA 98332  
(253) 514-8879  
noble2505@comcast.net

**OCS-56B** Fairborn, Ohio June 13-20, 2011. Contact:

Glynn McCoy  
8683 S 262d E Ave  
Broken Arrow, OK 74014  
(918) 872-9350  
glynn.mccoy@cox.net

**316th Tactical Airlift Wing** Fairborn, Ohio June 21-26, 2011. Contact:

Jerry Haines  
2411 S Tecumseh Road  
Springfield, OH 45502  
(937) 325-9306  
gerald\_haines@yahoo.com

**87th Aerial Port Association** July 7-10, 2011 Fairborn, Ohio. Contact:

Helen Redwine-Smith  
577 Winona Drive  
Fairborn, OH 45324  
(937) 879-2299  
hfrbrn@aol.com

**359th Fighter Group** July 22-24, 2011 Dayton, Ohio. Contact:

Curtis Jennings  
3383 Heritage Oaks Drive  
Hilliard, OH 43026  
(614) 571-9764  
curtis.jennings@bmwfs.com

**B-52 Association** Dayton/Fairborn, Ohio August 9-12, 2012. Contact:

Wayne Pittman  
PO Box 340501  
Beavercreek, OH 45434-0501  
(937) 426-1289  
kwavn@earthlink.net

**9th Bomb Group** August 22-25, 2011 Dayton, Ohio. Contact:

Rollin Maycumber  
2523 Sherman Street  
Hollywood, FL 33020  
(954) 920-7096  
diefrodo@bellsouth.net

**Laredo Escadrille (PTC-66E)** September 8-10, 2011 Fairborn, Ohio. Contact:

J. Stewart Mosbey  
PO Box 653  
Williamson, GA 30292  
(770) 584-2272  
firstflysqn@aol.com

**489th Bomb Group** Dayton/Fairborn, Ohio September 8-11, 2011. Contact:

Bill Smith  
6016 Yarmouth Drive  
Dayton, OH 45459-1452  
(937) 435-1585  
bsmith2040@hotmail.com

**836th Engineer Aviation Battalion (Army)** Fairborn, Ohio September 8-12, 2011. Contact:

Evelyn Midkiff  
361 Graystone Court  
Miamisburg, OH 45342  
(937) 847-0948  
emm1628@gmail.com

**The 355th Tactical Fighter Wing** September 23-25, 2011 Dayton, Ohio. Contact:

Gene Carlson  
1944 Tanglewood Drive  
Lafayette, IN 47905-4183  
(765) 448-1960  
grc46250@juno.com

**Laredo Escadrille (PTC-66E)** September 24-26, 2011 Fairborn, Ohio. Contact:

J. Stewart Mosbey  
PO Box 653  
Williamson, GA 30292  
(770) 584-2272  
firstflysqn@aol.com

**A-1 Skyraiders** September 29-October 1, 2011 Ft. Walton Beach, Florida. Contact:

Rocco DeFelice  
(210) 659-5965  
rdefelice1@satx.rr.com  
or  
John Larrison  
(830) 779-2000  
jonlarr@lavernnia.net

**5th Bomb Group** September 28- October 2, 2011 Dayton, Ohio. Contact:

Laura Scharer  
4363 Marian Waldo Road  
Marion, OH 43302  
(740) 389-1250  
waldowoods@earthlink.net

## 2012

**355th Fighter Group Association** Fairborn, Ohio October 4-8, 2012. Contact:

William Cook  
811 Old Forge Road  
Kent, OH 44240  
(330) 541-2653  
bigbilldot@aol.com

## 2013

**The B-52 Defensive Fire Control System Association** June 13-16, 2013 Fairborn Ohio. Contact:

Sharon Lemanek  
1326 Town Hall Road  
Beavercreek, OH 45432  
(937) 426-8557  
kenamel.sj@fuse.net

**List provided by:**

Rob Bardua  
National Museum of the U.S. Air Force  
Public Affairs Division  
1100 Spaatz Street  
WPAFB, OH 45433-7102  
(937) 255-1386

### **Capt. Robert C. Truax, USN (Ret.), 1917-2010**



Capt. Robert C. Truax, a rocket scientist who worked with Robert H. Goddard in the 1940s to develop advanced ballistic missiles, died of prostate cancer on September 17, 2010, at his home in Valley Center, California. He was ninety-three. A 1939 graduate of the U.S. Naval Academy, he served aboard the USS *Enterprise* aircraft carrier. Truax helped develop jet-assisted takeoff systems, which launched heavily-laden planes from carriers. He then earned MS degrees in both aeronautical engineering and nuclear engineering from the Navy's post-graduate school in Monterey, California, and Iowa State University. After the launch of Sputnik by the Soviet Union in October 1957, Captain Truax advocated creation of what became the National Aeronautics and Space Administration (NASA). He contributed to the design of the Navy's submarine-launched Polaris and the Air Force's Thor ballistic missiles. He also worked at the (Defense Advanced Research Projects Agency (D)ARPA until his retirement from federal civil service in 1959. He then joined Aerojet Corporation, where he was given an annual budget of one million dollars and allowed to design whatever he wanted. Captain Truax designed the X-3 rocket plane and a steam powered rocket intended to propel daredevil driver Evel Knieval over the Snake River Canyon in Idaho.

### **Maj. Gen. Richard D. Curtin, USAF (Ret.), 1915-2010**



Maj. Gen. Richard D. Curtin died on November 5, 2010, in Phoenix, Arizona. He was ninety-five. A 1939 graduate of the U.S. Army Military Academy, at West Point, he served in Headquarters, Ninth Air Force during World War II and received two bronze star medals. He earned an MS degree in aeronautical engineering from the University of Michigan in 1950. During the 1950s and 1960s Curtin played a key role in the development of long-range ballistic missiles. His final assignment was as U.S. Deputy Defense Advisor to NATO headquarters in Belgium. He was a senior manager with several aerospace corporations.

### **Samuel T. Cohen, 1921-2010**



Sam Cohen, a nuclear physicist credited with developing the concept of a neutron bomb, died on November 28, 2010, at his home in Brentwood, California. Cohen died of complications from cancer surgery. He was eighty-nine. A longtime employee of the Rand Corporation, Cohen's concept was for an enhanced nuclear bomb to be placed somewhere in Europe during the Cold War as a deterrent to a large scale attack by Soviet forces. The bomb was intended to kill more Soviet troops than European civilians, and leave the buildings intact.

## Sheldon Abraham Goldberg (1939-2010)



Sheldon A. Goldberg, career-long historian with the Air Force History Program, passed away on December 27, 2010. Sheldon was born on September 13, 1939 in the Bronx, a borough of New York City. This residence provided him with a life-long, “fanatic fan” connection to the New York Yankees. Sheldon often walked from his home to Yankee stadium to enjoy watching his team play, especially during one of their most successful runs in the late 1950s and early 1960s.

Educated in the New York City school system, he earned both his BA and MA degrees in history from New York University. Sheldon began his civilian Air Force career in 1964, when he joined the history staff at HQ Eighth Air Force at Westover Air Force Base, in Chicopee, Massachusetts. Three years later, he moved to HQ Strategic Air Command (SAC) at Offutt AFB, in Omaha, Nebraska, where he served as the archivist for nearly twenty years. In May 1986, Sheldon joined the Office of Air Force History in Washington, D.C., as the office’s declassification specialist. Assigned to the reference branch, Sheldon became the focal point for many inquiries from within and outside of the U.S. government. He was

responsible for responding to many critical and some highly publicized inquiries, including Operation Tailwind and the No Gun Ri controversy. Sheldon eventually rose to become chief of the Reference Branch and remained in that position until retiring in October 2004. While not known as a writer, he produced several excellent and useful archival tools on topics that he had thoroughly researched, such as, “A Brief History of the Air Force Uniform.”

Following retirement, he worked part time for the Air Force declassification team, mostly at the National Archives, where his expertise on the location and specifics of Air Force records proved invaluable. Sheldon A. Goldberg died of pneumonia. He is remembered as a quiet man with a subtle and sometimes understated sense of humor who did research for innumerable people and organizations in a professional and friendly manner.

George M. Watson, Jr., Ph.D.

## Guidelines for Contributors

We seek quality articles—based on sound scholarship, perceptive analysis, and/or firsthand experience—which are well-written and attractively illustrated. The primary criterion is that the manuscript contributes to knowledge. Articles submitted to *Air Power History* must be original contributions and not be under consideration by any other publication at the same time. If a manuscript is under consideration by another publication, the author should clearly indicate this at the time of submission. Each submission must include an abstract—a statement of the article’s theme, its historical context, major subsidiary issues, and research sources. Abstracts should not be longer than one page.

Manuscripts should be submitted in triplicate, double-spaced throughout, and prepared according to the *Chicago Manual of Style* (University of Chicago Press). Use civilian dates and endnotes. Because submissions are evaluated anonymously, the author’s name should appear only on the title page. Authors should provide on a separate page brief biographical details, to include institutional or professional affiliation and recent publications, for inclusion in the printed article. Pages, including those containing illustrations, diagrams or tables, should be numbered consecutively. Any figures and tables must be clearly produced ready for photographic reproduction. The source should be given below the table. Endnotes should be numbered consecutively through the article with a raised numeral corresponding to the list of notes placed at the end.

If an article is typed on a computer, the disk should be in IBM-PC compatible format and should accompany the manuscript. Preferred disk size is a 3 1/2-inch floppy, but any disk size can be utilized. Disks should be labelled with the name of the author, title of the article, and the software used. Most Word processors can be accommodated including WordPerfect and Microsoft Word. As a last resort, an ASCII text file can be used.

There is no standard length for articles, but 4,500-5,500 words is a general guide.

Manuscripts and editorial correspondence should be sent to Jacob Neufeld, Editor, c/o *Air Power History*, 11908 Gainsborough Rd., Potomac, MD 20854, e-mail: editor@afhistoricalfoundation.org.



## **Brig. Gen. Robert C. Richardson III, USAF (Ret.) (1918-2011)**



The only child of Lt. Gen. Robert Charlwood Richardson Jr., “Bob” Richardson grew-up in the interwar Army cavalry following his father from assignments in the Philippines, Europe, West Point, and Texas. A talented polo player, he attended Valley Forge Military Academy and graduated from West Point (Class of 1939) and from undergraduate pilot class of 1940A, where he went into the U.S. Army Air Corps. He started off as a bomber instructor pilot, then went into pursuit aviation. In 1942, he stood-up and commanded the 1st Composite Squadron, a mixed unit of P-39Cs and B-25As, sent to defend Ascension Island in the South Atlantic. During the September 1942 “Laconia Affair,” his decisions and actions led ultimately to the German Atlantic and U.S. Pacific decisions to conduct unrestricted submarine warfare.

In late 1942, while still on Ascension Island, he boasted over drinks to a transiting Air Staff team that it would be easy to fly pursuit aircraft across the South Atlantic air route. In March 1943, the Army Air Corps called him back home to successfully organize and lead a flight of fifty-three P-38 Lightnings from Florida to Morocco via the South Atlantic air route to reinforce U.S. air forces supporting Operation TORCH, a real feat of airmanship covering over 7,000 nautical miles. From there he returned home as the chief of the

Fighter Division, Army Air Forces Board where he test flew a number of the experimental aircraft to include the XP-59A, Airacomet. A year later, he returned to the European air war, as the Army Air Forces Board liaison to General Spaatz’s headquarters briefing fighter units on limitations of and tactics against the new German jet fighters. During the Allied campaign across France, he flew numerous combat missions in P-47 and P-38 aircraft, as part of the IX TAC Operations staff. He ended the war as Group Commander of the 365th Fighter Group, “The Hell Hawks,” based at Fritzlar, Germany.

He was a renowned expert in tactical nuclear warfare, NATO, and political-military long range planning. Fluent in French, Richardson helped lay the military foundations of NATO in drafting its initial war and nuclear plans. His assignments include multiple tours at the Pentagon and HQ NATO, standing up the 86th (now 4th) Fighter Wing at Seymour-Johnson AFB, N.C.; coordinating NATO Live Oak air responses to Soviet attempts to shut down the Berlin air corridors; and toward the end of his career drafting and executing USAF and nuclear acquisition policies in the Air Force Systems Command. A command pilot with more than 3,500 flying hours, he flew just about every World War II and early 1950s American warplane that existed. Known as one of the Air Force’s “boy” generals, he retired from the United States Air Force in 1967.

Richardson then started his second career as an author, lecturer, and policy advocate for conservative viewpoints regarding defense and national security policy issues. A recognized authority on tactical nuclear warfare and defense technology acquisition, he served as a consultant to the Los Alamos National Laboratory from 1971 to 1979, U.S. and European aerospace industries, and the Stanford Research Institution. One of his most enjoyable venues was as a guest lecturer for the Science Fiction Writers’ Association.

In 1981, he teamed up with Lt. Gen. Daniel O. Graham, USA (Ret.) on a Heritage Foundation project called “High Frontier: a New National Strategy”—the intellectual foundation for President Ronald Reagan’s Strategic Defense Initiative (SDI) that led to establishment of today’s Missile Defense Agency. In his more than two decades as Deputy Director of High Frontier, Richardson successfully lobbied for SDI (popularly known as “Star Wars”), established the Space Transportation Association, advocated the Single Stage to Orbit (SSTO) vehicle as a follow on to the Space Shuttle. More recently, he helped develop a long term strategy to colonize the Moon as a stepping stone to travel to Mars.

On the personal side, his family and friends will remember him for his courtly, old world manners, his fabulous breakfasts over a wood burning stove, his “absent minded professor” persona, his “Rube Goldberg” home fixes, and for always asking, “Do you need anything?” even when he could no longer do anything for himself. He died on January 2, 2011, three days shy of his ninety-third birthday.

His wife of more than sixty years, Anne Waln Taylor Richardson of Philadelphia, died in 2009. He is survived by his daughter, Newbold Richardson Smith of Alexandria, his son, Col. Robert C. Richardson IV (USAFR), of Annapolis, Maryland, his daughter Lydia R. Cardin of Andover, Massachusetts, and six grandchildren. He will be buried in late April with his wife at the family plot in the U.S. Military Academy (West Point) cemetery. The family request that in lieu of flowers, donations be made to the Salvation Army.

*Col. Robert C. Richardson, IV, USAFR (Ret.)*



The mystery aircraft in our Winter issue was the UV-18B, the U.S. Air Force version of the De Havilland Canada DHC-6 Twin Otter. The 98th Flying Training Squadron operated three of the twin-engine, high-wing UV-18Bs for free-fall parachute training and to drop the Academy Parachute Team, the Wings of Blue.

Two 620-horsepower Pratt & Whitney Canada PT6A-27 turboprop engines power most versions of the Twin Otter. De Havilland (now Boeing Canada) began design work on the civil DHC-6 in January 1964. The Twin Otter made its first flight on May 20, 1965. The fourth principal version, the Series 300 with PT6A-27 powerplants, was announced in 1969 and began with the 231st Twin Otter built. A Series 400 version with PT6A-34/35 engines was introduced in 2008.

The UV-18A was a U.S. Army aircraft, six of which were used by the Alaska National Guard's 207th Arctic Reconnaissance Group. This version was purchased beginning in 1976, as a short takeoff and landing, STOL-capable, administrative, logistical and personnel transport to operate through northern and

western Alaska on a year-round basis. The Army's Golden Knights parachute team operated a UV-18A.

The Twin Otter is 51 feet 8 inches long with a wingspan of 65 feet. Typical gross weight on takeoff is 12,700 pounds. The aircraft operates with two pilots.

Nearly half a century after it was introduced, the Twin Otter remains one of the most popular regional airliners in the 19-passenger category. When production ended in 1988, some 844 had been built. With its STOL capability and its ability to operate on water using floats, the Twin Otter is also popular with bush pilots. In addition, the Twin Otter is popular with commercial skydiving operations.

Our follow-up photo courtesy of Gary Chambers shows UV-18B 77-0464 wearing both Air Force markings and the civilian registry N70464 on July 21, 2007.

Twenty-nine readers responded to our "name the plane" challenge. All provided the right answer. Our "History Mystery" winner, chosen at random from correct entries, is Alexander Fischer of Baldham, Germany. He'll receive as his prize a copy of the book "Hell Hawks," a history of a P-47 Thunderbolt fighter group in World War II.

Can you identify this issue's "mystery" aircraft? Remember the "History Mystery" rules:

1. Submit your entry on a postcard. Mail the postcard to Robert F. Dorr, 3411 Valewood Drive, Oakton VA 22124. Entries may also be submitted via e-mail to robert.f.dorr@cox.net.

2. Name the aircraft shown here. Include your address and telephone number. Entries not accompanied by both an address and a phone number will be disqualified.

3. A winner will be chosen at random from among correct entries and will receive an aviation book.

And let's get serious about those historical treasures in your attic or basement. Some veterans say they just don't remember where their color slides are. Dig out your slide or snapshot of a rare aircraft and lend it to Air Power History for this contest.



## This Issue's Mystery Plane



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